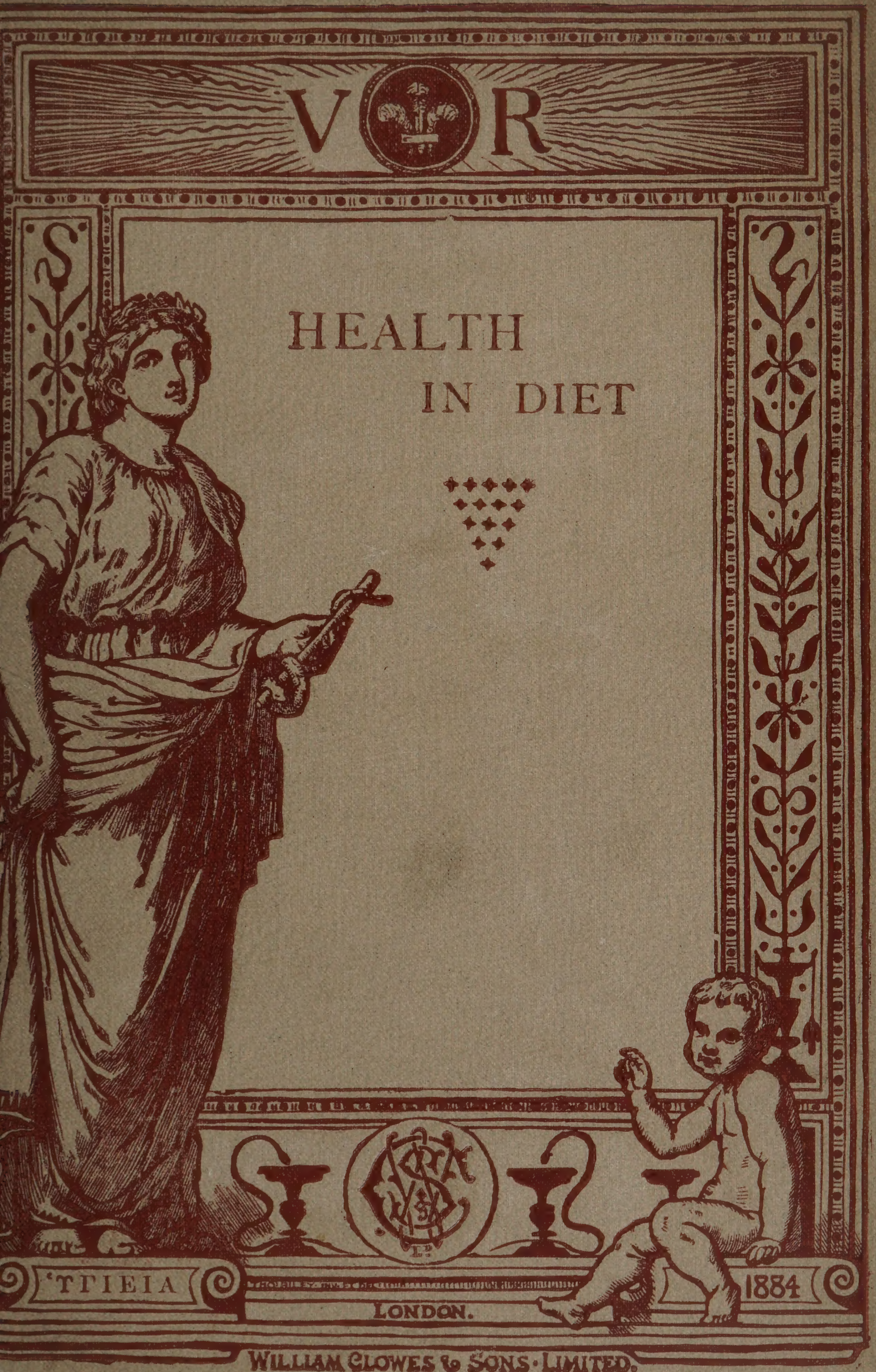
HEALTH IN DIET



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INCORP. XLV. VICTORIA LONDON

International Health Exhibition,
LONDON, 1884.

THE

HEALTH EXHIBITION LITERATURE.

VOLUME V.

HEALTH IN DIET.

CONFERENCES.

THE MEAT SUPPLIES OF THIS COUNTRY.
THE ADULTERATION OF FOOD.
BEE-KEEPING.

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CONFERENCES.

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THE MEAT SUPPLIES OF THIS COUNTRY.

CONFERENCE ON WEDNESDAY, JUNE 18th, 1884.

THE SOURCES OF OUR MEAT SUPPLY.

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THE MEAT SUPPLIES OF THIS COUNTRY.

CONFERENCE ON WEDNESDAY, JUNE 18, 1884.

1. "*The Sources of our Meat Supply.*" By Major P. G. CRAIGIE.
2. "*The Causes which have checked the Development of our Home Production of Meat.*" By THOMAS DUCKHAM, M.P.
3. "*Home-grown Meat Supply and the Increased Production of Home-grown Meat.*" By JOHN CLAY.
4. "*The Means of securing the Supply of Meat to Largely Populated Centres.*" By S. B. L. DRUCE.

THE EARL OF SUFFOLK AND BERKSHIRE (Vice-Chairman of the Central Chamber of Agriculture for 1884), who presided, in opening the proceedings and stating what would be the order of business, said those who had urged on the Government the necessity of adopting the House of Lords' Amendments to the Cattle Diseases Bill, had almost pledged themselves to the statement that the restrictions proposed on the importation of foreign cattle would not materially enhance the price of meat. He himself took the very strongest view on that subject, for he felt perfectly certain that increased security would be followed by such increased production, that in reality the price to the consumer would be reduced; and he should be both surprised and disappointed if this view were not borne out by the proceedings of that Conference.

THE SOURCES OF OUR MEAT SUPPLY.

By MAJOR P. G. CRAIGIE,

Secretary of the Central Chamber of Agriculture.

RECENT controversies over the spread and consequences of imported diseases among the live stock of this country have not unnaturally directed the attention of enquirers into the present extent and the possible expansion of the meat supply of this country, while there is probably no question during the recent years of agricultural depression which has been more frequently agitated than the propriety and profitableness of meat production being attempted in this country on a larger scale than has been customary in the past epoch, when prices of corn were remunerative to the farmer. Before inviting discussion, therefore, on these points, it may be useful to make some endeavour to set out what is the probable amount of butchers' meat furnished in one shape or another to the inhabitants of the United Kingdom.

There may be raised in one or two quarters, but hardly, I anticipate, with any emphasis in this room, what I may call in a sense "the previous question," whether it is well for our people to demand a meat diet at all, or, at least, to rely so largely as we do on animal food. Without inviting a vegetarian discussion, I may be allowed to quote the old plea in favour of meat-eating, that it is but one form of economy of labour, and that the use of flesh as food may be supported on the ground that, in eating meat, we are simply using the stomachs of other animals to do that which we could not so well do with our own. In butchers' meat we are certainly able to receive in a more concentrated and more easily appropriated form certain elements of necessary food, which, in any other shape, we could not possibly assimilate with anything like the same rapidity and ease. Granted, therefore, that we must have animal food, my object to-day is to ask from what sources do we usually gather our supplies.

Beef or veal, mutton or lamb, pork, bacon or ham are not of course the only animal food which might come under review in a survey of our meat supplies. If the horse has not yet descended from the place which he holds in an Englishman's sense of propriety, and claimed an entry among food-yielding animals in this country, there is still a large amount of animal food involved in the poultry, the game, the rabbits, the wild fowl of all sorts, and, I should probably add, the eggs which are annually consumed in the United Kingdom. Important as they are, I do not propose, for the purpose of this merely introductory paper, to embrace any calculations of the peculiarly uncertain statistics of what I may call the minor and miscellaneous articles of the larder; nor do I attempt to include the cognate, but distinct, branch of animal food involved in the supply of milk, butter, and cheese. No record of our home production, in Great Britain at all events, is kept that I could appeal to as furnishing any figures worthy of your consideration. Limiting the question, then, to the produce of cattle, sheep, and pigs, the statist who would estimate the present consumption of the country has at least two guides to rely upon—the yearly census of these animals, so far as they are enumerated on British and Irish farms, and the records of the imported animal produce, alive or dead, which comes from other lands to feed the growing wants of our population. This population, we must all of us admit, has for long been in excess of the number who could be exclusively supported on the yearly out-turn of our home produce. There were in the United Kingdom, in the middle of last year, some 35,631,000 persons of all ages, and there were available for food, or in process of development, in round numbers, 10,000,000 head of cattle, 28,000,000 head of sheep, and 4,000,000 pigs. By no process of calculation of which I am aware, and under none of the estimates of the annual yield of meat from the stock above enumerated which I have met with, could we feed, with the customary allowance of animal food, the population of the islands, unless we very materially increase these totals of our stock. No inconceivable portion of the people's rations must in some form or another be raised abroad, and it must not be forgotten that the acres of other lands than our own are now laid under yearly contribution to fatten our British live stock, and this not alone in the foreign feeding stuffs and cake employed, but in the additional produce of our farms due to the application of manures of foreign and often distant origin.

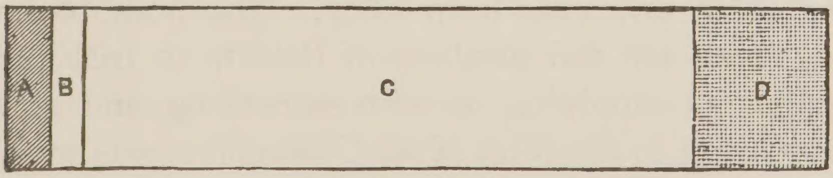
The meat-producing animals of the United Kingdom have by no means increased in the same ratio as the meat-consuming animal, viz., the human race. It is true we possess only an authentic live stock census for the past sixteen or seventeen years, yet the growing gap between home supplies and home wants is very clearly apparent when anyone compares the figures of the past with our present statistics. We had in the year 1868 9,000,000 cattle, 35,600,000 sheep, and 3,000,000 pigs—in all nearly 48,000,000 living animals, and there were but 30,300,000 inhabitants of the United Kingdom in that year. To come to a still later period, let us contrast the 48,500,000 animals of 1874, with the 32,400,000 of our population in that year, and then turn to the figures which confronted us last season when our 35,600,000 people possessed a total live stock which did not then reach 42,500,000 head, even after a recovery from the losses apparent a year or two before. This is an absolute as well as a relative decrease, and while the mouths have multiplied, the meat forthcoming at home is less. Indeed, if certain old writers are to be believed, the decrease of available meat supply is even more apparent if we were to carry our survey further back, and place any reliance on the estimates of what I may call, not certainly pre-historic, but, perhaps, pre-statistical times. A hundred years ago Arthur Young would have it England by herself stood possessed of 3,500,000 cattle, and we know that the population of this section of our island at that period is not believed to have exceeded 7,000,000, that is to say, we possessed one head of horned stock for every two persons living on our soil. To-day, England, with her 27,000,000 souls, only rears, it would seem, some 4,200,000 cattle, so that were we isolated from the surplus beef produced in Ireland and in Scotland, as well as abroad, we should stand in the position, as compared with our forefathers a century ago, of having, with what is generally recognized as a larger appetite for meat, nearly seven persons instead of two claiming his share of each head of cattle.

Nor is the case better as regards our flocks. Several foreign estimates have been made purporting to show that Great Britain was early in this century the mistress of forty or fifty million sheep. I have seen, however, no evidence, that this was ever proved to have been the case. A far more reliable calculator, like McCulloch, used figures which will suffice for my case. He put the entire English flock at 26,000,000, the Scotch at 3,500,000, and the Irish at 2,000,000, as recently, as 1847. England had then a population well under 17,000,000, that is to say, less than two persons for every three now living. But, according to the authority just quoted, she then maintained half as many more sheep as she now has when she is blessed with 27,000,000 inhabitants. It will be obvious, therefore, that the increase in the Scotch and Irish flocks which, if McCulloch is right, has occurred in the course of a single generation [from five and a half to ten millions] is no sufficient set-off for the reduction of the sheep stock of our English and Welsh pastures from 26,000,000 in 1847 to 21,000,000 in 1868, and now to 18,000,000 in 1883. With such data before us, it cannot be wondered at that some uneasiness has been occasioned at the increased reliance of the nation on foreign meat supplies, that consumers are paying more for their meat, and that the scramble to share in these bigger prices has led occasionally to a degree of carelessness in the sources of our foreign supplies which has resulted in the importation of disastrous diseases among what is left of our stock, sometimes, as statistics have proved, with the ultimate infliction of far greater real loss to the food supply of the nation than the actual absence of such dangerous imports would have caused. It cannot be, therefore, amiss that we should meet together here in a building devoted to the illustration of the best means of maintaining the public health and securing the best form of food for the people, to discuss how we may develop the animal wealth of our own country, and, if we must supplement our home efforts, how we can feed our huge workshop population with meat, either imported alive from healthy as distinguished from more or less diseased districts, or else imported in what many of us regard as the safer form of dead meat which the resources of modern science now place within reach of the importer.

In offering you an estimate of what our supplies are, whereon to found this day's discussion, for I do not attempt to do more in the course of this paper, I take as my basis for the meat product of each year from our home stock, which is so immensely the largest factor in the calculation, the estimate that something like one fourth of the cattle enumerated in June, two-fifths of the sheep, and at least one-sixth more than the enumerated pigs are annually slaughtered for the people's food. Although I am aware this is a point on which opinions differ, I believe such a basis may be roughly relied on as indicating, for comparative purposes, the available supply.

Of course it would be rash to assert that in a calculation attended by many elements of uncertainty the method employed reflects with exact accuracy our present meat outturn in the United Kingdom; but I could quote, were it needed, a fairly long record of authorities who have deemed the scale, if rough and ready, yet a fair and practicable one. We may accept it, at least for such general purposes as our discussion to-day, pending the time when, either by means of the enquiry the Royal Agricultural Society have been urged to make, or by other researches, more definite data are forthcoming. I fear, however, we shall be much in the dark as to the actual weights of animals slaughtered until such time as farmers abandon their apparently inexplicable practice of failing to use the only true measure of value, viz., weight, in the daily business transactions by which they sell the meat that is manufactured upon British farms.

Working out, on the plan above indicated, and on the basis of the 1883 animal census, the weight of home-grown meat would come out as 1,307,000 tons. The official records of our imports shew that in the same year 301,000 tons were imported as dead meat from foreign or colonial ports, and the estimate most nearly in accord with the recently issued official weights of live foreign animals, leads to the conclusion that 173,000 tons will represent quite the outside figure of the foreign live supply. The total consumption of 1883 thus reaches 1,781,000 tons of meat; and in the accompanying diagram I have in a form, appealing more directly to the eye, shown the relative magnitude of our home and foreign meat supplies. These consist in far the largest proportion, three pounds out of four, of our own produce. Only the rest is derived from foreign sources, alive or dead, as the case may be. In this diagram I have also indicated the proportion of our supplies coming from countries tainted more or less with foot-and-mouth disease.



A. Proportion of meat received alive from countries which have sent us foot-and-mouth disease.
B. „ „ received alive from countries which are undoubtedly free from foot-and-mouth disease.
C. „ „ produced at home.
D. „ „ imported as dead meat.

I leave it to those who are to treat of the special points of this Conference to explain the causes underlying the changes that have been from time to time apparent in our home meat supplies, and especially the decline which followed 1874. I leave it to them also to argue how larger supplies are to be raised at home, and how the problem of finding the capital required for heavier stock-farming is to be met; and I leave it also to other and to foreign or colonial speakers, to tell us what are the prospects of larger foreign supplies, remembering that we must never dissociate from this problem how the risk of importing disease is to be eliminated, and how we can improve our machinery of live or dead meat distribution at home.

There are, however, two or three notes on the composition of our supplies I desire to offer. First, as regards the relative proportions of the cattle, sheep, and pigs consumed as meat. In so far as our home-stock is concerned, it would appear that the 1,300,000 tons I assume for the purpose of this paper to have been placed on the market last year, rather more than half, or some 670,000 tons, consist of beef or veal. This is a larger figure than in any one year since 1873–5. Not much over 4 per cent. of this has been computed to consist of veal. Half as much as the beef, or somewhat over 350,000 tons, may be credited to our flocks in the shape of mutton or lamb; and, according to the estimates made in some quarters, more than 12 per cent. of this is consumed as lamb. Unlike the beef supply, that of mutton is, with the exception of the two immediately preceding years, 1881 and 1882, considerably less than could be estimated in any year from 1867. The pork, bacon, and hams, which are the produce of British or Irish pigs, are computed as supplying us with something under 280,000 tons. Owing to the form of our Customs records we cannot tell with perfect accuracy how much of dead meat is beef, and how much mutton, for any long series of years. Since the great trade in frozen mutton sprung up, some three years ago, a separate entry of the mutton thus prepared has been given, but there is no distinction drawn in the imports of tinned and preserved meats between the produce of the cow or the sheep, while I understand that the meat of another animal, the rabbit, is now not by any means an infrequent item of this class of provisions. Grouping, therefore, in one item foreign dead supplies of beef and mutton, we find a total of over 98,000 tons in 1883, a figure greatly in excess of any previous year, while more than twice this amount, or 203,000 tons, represents the bacon, hams, and pork imported in the same year. Owing, no doubt, to the much greater ease of transporting and handling salted provisions, it will be seen that in the dead meat imports the English pig meets a far stiffer competition than falls to the lot of the ox or the sheep. In the live animal trade the positions are exactly reversed, the entire weight of foreign live pigs landed on our shores does not apparently reach 2000 tons, quite 99 per cent. of live imports being beef and mutton.

Lastly, I would invite attention to the remarkable changes in the sources of our foreign live supplies. Thus, in 1883, taking the case of cattle alone, 208,000 head out of a total of 473,000—that is to say, 44 per cent.—come across the Atlantic, i.e., from the United States or Canada. Ten years before, this trade did not even appear in the Official Returns, and in 1877 it did not reach 20 per cent. of the whole. Another remarkable increase is in the Scandinavian trade, where Denmark, Norway, and Sweden, which sent us only 8000 cattle in 1869 out of 220,000, now supply 147,000 out of 473,000 last year. It is at least satisfactory to those who contend that our duty is to welcome supplies from those countries which have made a successful effort to keep themselves free from disease, to contrast these figures with the stationary or receding amount of the live animal trade from countries like Spain and Portugal, whence the import in 1870 was even greater than it is at present; or the trade with Belgium, Holland, France, and Germany, whence we get no growing supply, and whence we need under no circumstances look for an increase. All of them collectively do not send us nearly as many cattle as their little neighbour Denmark; and though the German sheep exports, if not actually increasing, form yet a very considerable trade, it is one which we know to be carried on from a steadily diminishing source. The reduction of the flocks of Germany and several Continental nations have been of late years even greater than our own. Even, therefore, if our farmers cannot in this Conference show us that our own soil can rear a full and sufficient supply of meat for our own people at present—and even if any check should occur to what I believe to be the growing dead-meat trade—on the whole it cannot but be gratifying to note that it is precisely from those countries whence the safest imports may be brought that any increased supplies to fill up the vacuum are likely to be obtained. This should give our statesmen courage to resist the offer of these exceptionally dangerous imports from countries which are tainted with disease, which in time past have been too often a cause of a diminishing meat supply to the people of the United Kingdom.

THE CAUSES WHICH HAVE CHECKED THE DEVELOPMENT OF OUR HOME PRODUCTION OF MEAT.

By THOMAS DUCKHAM, M.P.

IT is, I consider, beyond any question, that of all other causes, the seasons have the most direct influence in increasing or decreasing our home productions of animal food, and, as those are regulated by the Divine will, over which the cultivators of the soil can have no control, their duty to their country ceases when they have used their best exertions towards making it render its full increase. Under the heading of this paper it becomes my duty to consider whether that desiderata has been attained, and if not, what have been the counteracting influences. Agricultural statistics were first collected for Great Britain in 1866, but, as they were for that year very incomplete, I commence my researches in those for 1867. They show that in Great Britain and Ireland, including the Isle of Man and Channel Islands, there were 45,387,066 acres of land under corn and other crops, bare fallow and grass;

of that acreage there were in Great Britain 11,967,988 acres of permanent pasture, 9,284,780 acres of corn crop, 3,498,163 acres of green crops, 3,989,974 acres of grass, clovers, &c., in rotation, and 922,558 acres bare fallow. In Ireland there were 10,057,072 acres of permanent pasture, 2,115,137 acres of corn crops, 1,432,252 of green crops, and 1,658,451 acres of grass, clovers, &c., in rotation, and 26,191 acres of bare fallow. But the acreage of permanent pasture for Ireland included a large area of mountain or other lands which were retained in the returns up to the year 1877, when 364,022 acres were transferred to mountain, bog or waste lands. Therefore the permanent pasture in Ireland for 1867 should appear as 9,693,050 acres, and the total in the United Kingdom as 21,661,038 acres. In 1883 there were 47,655,230 acres under corn and other crops, bare fallow and grass, being an increase of 2,632,186 acres. The acreage of permanent pasture in Great Britain had increased to 15,065,373 acres, and in Ireland to 10,191,118 acres, making a total of 25,256,491 acres, showing an increase of 3,595,453 acres. Of that great increase there are 3,097,385 acres in Great Britain, and 498,068 acres in Ireland. A further reference to the returns show that in Great Britain there were 754,714 acres less wheat, and 20,081 acres less roots grown in 1883 than in 1867; whilst there were 32,287 acres more barley, and 224,894 acres more oats, and 405,948 acres more clover, sainfoin, and grasses in rotation grown in 1883 than in 1867. In Ireland there were 167,106 acres less wheat, 11,378 acres more barley, 278,541 acres less oats, 201,999 less roots, and 272,650 acres more clover and grasses in rotation.

The foregoing statistics show that, notwithstanding there was, during the past 16 years, a very great increase of cultivated land, the area of wheat was very greatly decreased, the question naturally arises, What is produced as compensation for this great decrease as food for man? For the answer we naturally look to the live stock returns. In doing so, I feel it right to take the returns for 1868, because those for 1867 were seriously affected by the losses sustained from that direful calamity the cattle-plague and other diseases amongst our flocks and herds. I also consider it the more correct course, as the returns for live stock are made in June, whilst the returns for growing crops represent those of the current year. This fact points to the desirability of obtaining returns of live stock twice in the year—a question I raised in the House of Commons a short time since, and I hope to do so again and again, until they are obtained.

LIVE STOCK RETURNS.

GREAT BRITAIN.

	Cattle.	Sheep.	Pigs.
1868	5,423,981	30,711,396	2,308,539
1883	5,962,779	25,068,271	2,617,757

IRELAND.

	Cattle.	Sheep.	Pigs.
1868	3,620,352	4,822,444	862,443
1883	4,096,021	3,219,098	1,351,990

	GREAT BRITAIN.		IRELAND.	
1883—	Increase of cattle,	538,798	Increase of cattle,	475,669
„	Decrease of sheep,	5,643,125	Decrease of sheep,	1,603,346
„	Increase of pigs,	309,218	Increase of pigs,	489,547

Before commenting upon those figures, I think it right to state that the sheep in Great Britain in 1868 were in excess of any other known year, a fact which arose from an unusual number of sheep being bred in that and the preceding year, as those whose pastures had been denuded of cattle by the plague feared further outbreaks of that direful disease if they stocked them with cattle. The effects of the calamitous seasons of 1879–1880 and 1881, when an enormous number of sheep died with the disease known as fluke or liver rot is not to be lost sight of in comparing the statistics for the sister Isles—yet, notwithstanding all the allowances that must be made for that calamitous visitation, there is something very startling in the fact that, with an increase of 3,097,385 acres of permanent pasture, and an increase of 405,948 acres of clover, &c., in Great Britain, that there should only be an increase of 538,798 cattle, whilst there is a decrease of 5,643,125 sheep. Those facts become the more striking when we find that, with an increase of 498,068 acres of permanent pasture, and an increase of 272,650 acres of clover, &c., in Ireland, there is an increase of 475,669 cattle, and a decrease of only 1,603,046 sheep. I cannot for a moment admit that the farmers of Great Britain are less intelligent or less persevering in their business than those of Ireland, and therefore I cannot help feeling that there must be something more than even the seasons, disastrous though they have been, to produce such a serious contrast in the supply of animal food furnished by the two islands. In my opinion, the reason is not far to seek—no business can flourish without security for the capital invested. That security the tenant-farmers of Great Britain long and loudly called for, but a deaf ear was turned to their call. They had to submit to an unjustifiable increase of rents, fostered under an arbitrary and cruel law of distress, an increase that was very frequently made upon the improvements they had effected on their holdings, or, if they did not so submit, they had to turn out and leave their capital in the soil for the benefit of others. They had to stand passively by and see their crops destroyed by game, whilst the lands they occupied and paid rent and taxes for were laid waste. They had to bear the brunt of increased taxation, and increased wages with less labour performed, notwithstanding the increased amount paid, and, added to all this, their capital was repeatedly filched from them by imported diseases amongst their flocks and herds, against which they were powerless to guard. It may be asked, had not the farmers of Ireland similar grievances to contend against. In reply, I say no; they had far greater security in their holdings, their crops were not destroyed by game, they had not such excessive burdens of taxation imposed upon them, they had not to contend with the labour question, and their flocks and herds have been better guarded from disease. The farmers of Great Britain are a law abiding and loyal class, and they bore for several years the burdens imposed with patience and endurance, but the result of the combined causes I have enumerated induced numerous good substantial men to retire from business with a limited income, rather than attempt to carry burdens which their experience showed them were too heavy to be borne, unless under very exceptional circumstances. Many others left the land of their birth with their remaining capital, and emigrated to distant lands, hoping to find better security for its investment. The sad experience of the past seven years has proved to many of those who resolutely endeavoured to combat with their position how fruitless were their endeavours. The unprecedented number of failures, the large area of the kingdom which has been thrown upon the landlord's hands in a wretched state of cultivation, much of which has gone altogether out of cultivation from want of tenants to occupy, on the one hand, and the want of knowledge, inclination, or capital of the owner, on the other hand, have all tended to produce the results which all must now deplore, when considering the humiliating position the statistics show the nation to be placed in.

Recent legislation has done much to correct the evils which have so materially contributed to produce these painful results. The efforts of tenants to grow crops upon their holdings are no longer to be frustrated by the destruction of ground-game. Advantage can no longer be taken of the improvements they effect upon their holdings without compensation. The arbitrary powers of the ancient law of distress no longer exist. Some relief of their burdens of local taxation has been given, and more relief has been promised. A re-adjustment of rents has very generally taken place, and last, not least, their flocks and herds are now guarded by legislative enactments from the importation of those diseases which have been fraught with such disastrous results to the owners, and have tended to so materially increase the price of animal food to the consumers in this densely-populated country. I will quote a few statistics to show how seriously the prevalence of disease has affected the price of meat. The average price of beef in the metropolitan market for the years 1864–5 and 6, when diseases were rife and unchecked, was 4*s.* 6¼*d.*, and of mutton 5*s.* 3*d.* per 8 lbs. The average value of importations of live animals for those years was £5,554,565, and of dead meat, £3,328,108. The cattle plague was stamped out in 1866, and with it other diseases that had proved so disastrous in the flocks and herds of the country. The average price of beef in the metropolitan market for 1867 was 4*s.* 2½*d.*, and of mutton 4*s.* 5½*d.* per 8 lbs. The value of the importations of live animals was £4,148,409, and of dead meat £2,701,202. In 1868, another healthy year, the average price of beef was 4*s.* 1⅛*d.*, and of mutton 4*s.* 3½*d.*, per 8 lbs. The value of the importations of live animals was £2,698,511, and of dead meat £2,891,012. It will be seen that during the three years when diseases were prevalent the average price of beef was 5*d.*, and of mutton 10½*d.*, per 8 lbs., more than during the two following years, when the flocks and herds of the country were comparatively healthy, and that notwithstanding the average value of the meat imported was £2,663,106 less than for the three preceding years. There are other similar cases to those I have quoted, which a careful investigation of the annexed tables will disclose, but I will pass them over and confine my further remarks upon this head to quotations from the returns for 1883. There were that year, in the United Kingdom, 265,526 more cattle, 899,340 more sheep, and 29,932 more pigs than in 1882. That great increase of live animals was calculated to yield an increase of meat for the year of 27,385 tons, supposing its production had not been so seriously interfered with by foot-and-mouth disease. Now, taking the increase of population at 400,000, and allowing 100 lbs. of meat as the consumption for the year of each person, they would require 17,857 tons to meet their demand, being 9,528 tons less than the extra production ; now, calculating the 27,385 tons at £80 per ton, the value was £2,190,960 —and that of the extra 9,528 tons of extra production, beyond the requirements of the increased population, £762,240, of which the general consumer should have taken the benefit, according to the first principles of political economy, viz., that supply and demand must rule the price of the article produced. But, in our meat supply, we find the very opposite result, as there was last year an increase in the importation of live animals of the value of £2,707,018, and of dead meat of the value of £3,653,422, making a total increase of £6,360,440 beyond the imports of 1882, and the average price of beef was 2½*d.*, and of mutton 7¾*d.* per 8 lbs. more than in 1882.

This clearly illustrates the fact that the losses sustained by the nation in 1883 from foot-and-mouth disease not only exceeded the value of the extra production, but that the value of the enormously increased importations failed to meet the deficiency created by the disease. There are not any statistics for Great Britain from which reliable calculations can be made of the losses. But there are official returns published, giving the exact number of animals annually received from Ireland, and as I have shown that there was a considerable increase of cattle and sheep in Ireland in 1883 as compared with 1882, and as the price of both fat and store stock ruled very high in Great Britain throughout the past year, there was every reason to expect increased receipts from Ireland had the supply not been interfered with by disease. The following table will show that the reverse was the case:

RECEIVED FROM IRELAND.

	1882.	1883.	Decrease.
Fat Cattle	291,777	229,603	62,174
Store „	427,798	278,518	149,280
Other „	3,006	1,819	1,187
Calves	59,693	46,927	12,766
Total . . .	782,274	556,867	225,407

I estimate the value of those 225,407 cattle thus deficient, and also of the 97,675 sheep which were likewise deficient in our supplies from Ireland last year, to be about four millions sterling—I have no doubt that much of the fat stock found its way to our dead meat markets, but its value was greatly depreciated to the producers.

The deficiency of receipts from Ireland arose from two causes; first, by the disease amongst the flocks and herds at home, and the prohibition which the authorities in Great Britain felt constrained to impose in consequence of the frequent outbreaks of disease amongst Irish stock upon its arrival on this side of the Channel. The loss occasioned by the prohibition was two-fold; first it fell heavily upon the Irish stock owners, who could not dispose of their animals, and secondly upon the graziers of Great Britain, who had an abundance of food which they were anxious to convert into meat, but could not obtain animals to consume it.

Notwithstanding the sad experience of the past forty-five years, during which long period the flocks and herds of the nation have been so seriously subjected to imported diseases, there are those who still stoutly adhere to the opinion that the diseases arise spontaneously in this country, that they are become acclimatised and indigenous to the soil. Unquestionably the climate is such that neither the extremes of heat nor cold are sufficient to affect them. But we have the fact that the regulations enforced for stamping out cattle plague during the years 1866, 1872, and 1877, had each time a decided effect towards ridding the country of pleuro-pneumonia and foot-and-mouth disease.

Since those visitations we have the experience of the working of the Contagious Diseases (Animals) Act of 1878, to which I have before referred, and experience has shown that those local authorities, who have acted firmly in enforcing the power placed in their hands by the Privy Council, have retained the health of the flocks and herds in their several counties. That when an outbreak has taken place it has rarely, if ever, occurred without its source being clearly traceable, and the adoption of strictly guarded cordons have rarely failed to prevent the spread. These things being so, it becomes apparent that prompt and stringent uniform regulations are essentially requisite to be enforced to free the country from the scourges which have so disastrously visited this nation for so many years past.

DISCUSSION.

Mr. W. J. HARRIS, M.P., said,—Of the two interesting papers which we have heard read, I confine myself in criticism to the last, viz., that by Mr. Duckham. With the paper by Major Craigie I entirely agree. Mr. Duckham has given us a long account of the decrease in corn growing in England, and the consequent increase in pasture during the last decade, and he argues therefrom that instead of our home supplies of meat decreasing they ought to have increased. I join issue at once with Mr. Duckham on this argument. I maintain that more meat is produced where corn is grown as well as grass, than where grass alone is produced. Mr. Duckham gives us the instance of Ireland, where the decrease in the number of cattle and sheep has not been nearly so great as in England, and he attributes this to the fact that the Irish farmers were lower rented and had smaller taxes and more grass land than in England. Surely Mr. Duckham must be aware that if this were indeed true, viz., that the conditions of farming in Ireland, as to rents, &c., were, during the period under review, so much more favourable than in England, he can hardly explain why the late Irish Land Act was so necessary. (Cheers.) I think, however, we may take it as an axiom that mixed farming produces more meat than any other, and that the increase shown in the number of stock in Ireland may be set down to store stock rather than to fat stock; in fact, the Irish farmer has adapted himself to the rearing rather than to the fattening of stock. The next

SUMMARY OF LIVE STOCK IN THE UNITED KINGDOM AND THE AVERAGE PRICE OF BEEF AND MUTTON IN THE METROPOLITAN MARKET FOR THE YEARS 1867 TO 1883 INCLUSIVE.

Year.	GREAT BRITAIN.			IRELAND.			Total in Great Britain and Ireland, including Isle of Man and Channel Islands.			Average Beef, per 8 lbs. Metropolitan Market.	Average Mutton, per 8 lbs.	Year
	Cattle.	Sheep.	Pigs.	Cattle.	Sheep.	Pigs.	Cattle.	Sheep.	Pigs.			
1867	4,993,034	28,919,101	2,966,979	3,702,378	4,826,015	1,233,893	8,731,473	33,817,951	4,221,100	4·2¾	4·5½	1867
1868	5,423,981	30,711,396	2,308,539	3,620,352	4,822,444	862,443	9,083,416	35,607,812	3,189,167	4·1	4·3¼	1868
1869	5,313,473	29,538,141	1,930,452	3,727,794	4,648,158	1,079,793	9,078,282	34,250,272	3,028,394	4.5¾	4·10	1869
1870	5,403,317	28,397,589	2,171,138	3,796,380	4,333,984	1,459,332	9,235,052	32,786,783	3,650,730	4·6¾	4·7¼	1870
1871	5,337,759	27,119,569	2,499,602	3,973,102	4,228,721	1,616,754	9,346,216	31,403,500	4,136,616	4·5½	5·3¾	1871
1872	5,624,994	27,921,507	2,771,749	4,057,153	4,262,117	1,385,386	9,718,505	32,246,642	4,178,000	4·9	5·8	1872
1873	5,964,549	29,427,635	2,500,259	4,151,561	4,486,453	1,044,218	10,153,670	33,982,404	3,563,532	5·5	6·1½	1873
1874	6,125,491	30,313,941	2,422,832	4,118,113	4,437,613	1,096,494	10,281,036	34,837,597	3,537,354	5·3¾	5·4½	1874
1875	6,012,824	29,167,438	2,229,918	4,111,990	4,248,158	1,249,235	10,162,787	33,491,948	3,495,167	5·2	5·11½	1875
1876	5,846,302	28,172,951	2,293,620	4,113,693	4,007,518	1,424,143	9,997,189	32,252,579	3,734,429	5·4½	6·1½	1876
1877	5,697,933	28,161,164	2,498,728	3,996,027	3,989,178	1,467,999	9,731,537	32,220,067	3,984,447	5·4¼	6·4½	1877
1878	5,738,128	28,406,206	2,483,248	3,984,751	4,094,230	1,269,340	9,761,288	32,571,018	3,767,960	5·4¼	6·2¼	1878
1879	5,856,356	28,157,080	2,091,559	4,067,094	4,017,889	1,071,990	9,961,536	32,237,958	3,178,106	4·10¾	5·9½	1879
1880	5,912,046	26,619,050	2,000,842	3,921,026	3,561,361	849,046	9,871,153	30,239,620	2,863,488	5·2¾	6·0¼	1880
1881	5,911,642	24,581,053	2,048,090	3,954,479	3,258,583	1,088,041	9,905,013	27,896,273	3,149,173	4·10½	5·11	1881
1882	5,807,491	24,319,768	2,510,402	3,986,847	3,071,493	1,429,930	9,832,417	27,448,220	3,956,495	5·1¾	6·4¾	1882
1883	5,962,779	25,068,271	2,617,757	4,096,021	3,219,098	1,351,990	10,097,943	28,347,560	3,986,427	5·4¼	7·0½	1883

SUMMARY OF THE ACREAGE OF LAND UNDER CULTIVATION IN THE UNITED KINGDOM.

Year.	GREAT BRITAIN.					IRELAND.					Total acreage, including Isle of Man and Channel Islands.	Year.
	Permanent Pasture.	Corn Crops.	Green Crops.	Bare Fallow.	Grass, Clover, &c.	Permanent Pasture.	Corn Crops.	Green Crops.	Bare Fallow.	Grass, Clover, &c.		
1867	11,967,288	9,284,780	3,498,163	922,558	3,989,974	10,057,072	2,115,700	1,432,352	26,191	1,658,451	45,387,066	1867
1868	12,136,036	9,433,532	3,385,866	958,221	3,960,008	10,003,918	2,192,785	1,456,307	24,017	1,691,797	45,652,545	1868
1869	12,735,897	9,758,037	3,575,067	738,836	3,448,726	10,046,877	2,207,970	1,468,895	20,981	1,669,800	46,100,153	1869
1870	12,072,856	9,548,041	3,586,730	610,517	4,504,884	9,990,968	2,173,109	1,498,719	19,054	1,775,835	46,177,370	1870
1871	12,435,442	9,675,261	3,738,180	542,840	4,369,448	10,068,843	2,124,079	1,511,532	22,323	1,827,733	46,667,178	1871
1872	12,575,606	9,573,551	3,616,383	647,898	4,513,451	10,241,513	2,090,673	1,473,916	18,512	1,799,930	46,868,290	1872
1873	12,915,929	9,458,928	3,576,486	706,498	4,366,818	10,420,695	1,930,824	1,372,420	13,474	1,837,483	46,926,917	1873
1874	13,178,012	9,431,490	3,581,270	660,206	4,340,742	10,472,161	1,901,508	1,353,362	12,187	1,906,083	47,143,320	1874
1875	13,312,621	9,451,650	3,664,107	557,979	4,354,071	10,431,776	1,916,398	1,370,086	11,287	1,943,923	47,313,789	1875
1876	13,515,944	9,194,669	3,571,874	651,212	4,540,273	10,507,249	1,848,487	1,363,224	11,652	1,861,464	47,393,450	1876
1877	13,728,355	9,210,129	3,584,846	616,147	4,494,216	10,145,227	1,861,847	1,354,853	16,678	1,925,168	47,263,185	1877
1878	13,911,296	9,167,646	3,491,010	632,423	4,573,107	10,124,745	1,831,421	1,317,760	16,971	1,942,716	47,326,615	1878
1879	14,166,724	8,985,234	3,554,318	721,409	4,473,373	10,198,139	1,761,800	1,294,636	16,295	1,937,348	47,436,820	1879
1880	14,426,959	8,875,702	3,476,653	812,566	4,434,339	10,261,266	1,766,424	1,247,359	15,366	1,909,907	47,586,700	1880
1881	14,643,397	8,847,976	3,510,568	795,809	4,342,285	10,091,688	1,776,877	1,268,997	21,186	1,998,402	47,646,112	1881
1882	14,821,675	8,833,380	3,475,660	784,425	4,327,392	10,110,079	1,756,819	1,248,954	21,263	1,961,773	47,655,230	1882
1883	15,065,373	8,618,675	3,454,579	778,203	4,395,922	10,191,118	1,678,125	1,230,253	24,698	1,931,101	47,667,274	1883

point I have to mention is the recent prevalence of foot-and-mouth disease. There is no doubt that this has acted in the most prejudicial manner, both on the success of farmers and in the home meat supply. I am fully convinced that the late legislation has not been in the least degree too stringent. It has simply put the onus on foreign countries of preserving a clean bill of health for themselves instead of giving to us all the trouble and expense of proving the existence of disease. It will make all those countries which depend upon our demand the more anxious to take such means as will stamp out the disease, and I look to the legislation of this session having the ultimate effect of stamping out foot-and-mouth disease all the world over. (Hear, hear.) That the complaint is not spontaneous in this country can be asserted with tolerable certainty. I can give some evidence on this point. I farm a tract of land on the Devonshire hills, where the business of the whole district is to rear cattle and sell them to more favoured districts. The consequence is that cattle are always going away and never coming to us, and as a consequence we have never had the epidemic of foot-and-mouth disease. (Hear, hear.) I believe that in the near future there will be an increase in our home supply, following upon the legislation so wisely passed by this Parliament. There is another cause which in my opinion will contribute in a marked degree to the increase in our meat supply. I refer to the system of ensilage, which has been already proved a success. I may mention that my own experiments have proved to me conclusively that at least 30 per cent. more cattle can be wintered on an ensilage farm than on the old system. (Hear, hear.) And now for a few words as to our supplies from abroad. We have seen the ability of the United States and Canada, and we may now add several other countries, as likely to equal, if not to exceed them. Australia and New Zealand can send us an almost unlimited supply of frozen mutton, and the River Plate and Brazil can likewise produce both beef and mutton at a very low price and in almost unlimited quantities. Until recently the difficulty has been to make these supplies available, but the discovery of the refrigerating process has made all the difference, and mutton now reaches us from the antipodes in just as good order as when it was shipped. In fact, there are persons willing to insure the whole risk of damage at 10*d.* per sheep. To show how this trade has grown since its commencement, I will give a few statistics from the London Dock Company's receipts. As one of the directors, I wish to say that the Company is willing to give these statistics simply as a contribution towards the discussion on this occasion, and not with a view of attaching to them any opinion. You must therefore understand that the statistics are the facts on which I rely, and any opinions that I found on them are my own. The trade commenced in 1881, and the landings to our refrigerated chambers in that year amounted to 11,355 sheep. In 1882 the landings in our refrigerating chambers amounted to 40,976 carcases. In 1883 we had to enlarge our storage room and all our appliances, and the quantity stored amounted to 108,703 carcases, while in this year up to to-day (18th June) less than half-a-year, the number has increased to 142,622. Thus the quantity arriving to our stores is more than doubling itself every year. The cost of bringing the mutton for freight and refrigerating while on passage is at present about 2*d.* per lb. With the great depression in shipping and the probability of discoveries of cheaper means of refrigerating, the cost will doubtless be reduced. When once landed in the dock chambers, the meat can be held without fear of injury for any reasonable time. There is no need to force it on an unwilling or depressed market. The cost per week for rent and keeping only amounts to 3·32 of a penny per lb., where the quantity is over 1000 carcases. On the other hand, to meet the daily wants of the market the following rates are under discussion and will probably be agreed to. Carcases delivered direct from ship to vans or railway trucks whilst the meat is being discharged, 3*d.* each. When several marks are imported in the same ship, 4*d.* each. Landing, housing, and delivery, including overtime and lamps at delivery and stowage for 48 hours, from breaking bulk, 8*d.* per carcase. Sorting in addition at chambers when several marks are imported on same manifest, 1*d.* each. Rent after 48 hours, 1½*d.* per cwt. per day, on market weight. Weighing at delivery, if required, ½*d.* each. Nothing would facilitate the manipulation and consequent reduction of dock charges so much as that each consignee should provide his shipper on the other side with a more distinct wrapper, so that they shall be easily identified for sorting on discharge. I may mention that the refrigerating chambers at our docks are immediately contiguous to the railway lines, and the meat can be loaded on trucks in the evening and delivered in the most distant town in England the next morning without fear of deterioration. In fact, the meat requires keeping for some little time after emerging from the frozen atmosphere, as if cooked at once it eats hard; whereas when kept for some days (more or less according to the season of the year) it has time to thaw thoroughly and becomes perfectly tender. The wholesale price of this mutton is to-day from 4¾*d.* to 5¾*d.* per lb. from the dock stores, and although this may not be welcome news to the English farmer, yet it is of inestimable importance to the working classes. When the quantities increase, as they no doubt will do, I apprehend that we shall see meat sold from costermongers' barrows in many of the crowded quarters in London where the working classes mostly congregate. There is only one other fact which I wish to bring forward as to the permanence of the supply. I can really see no reason for any fear on this head. The stock of sheep in Australia and New Zealand is nearly 80,000,000. It could easily be doubled or trebled. Since the refrigerating process has been discovered the value of sheep has nearly doubled there, thus stimulating the production. The vast capacities of the South American Continent have only been slightly trenched upon thus far. India has done nothing thus far in meat raising, the reason being that while cattle food is in luxuriant growth during the rainy season, it is quite wanting during the rainless period of the year. The discovery of the ensilage system, which is already being applied in India, may render the raising of meat in that vast continent an important trade. Russia is already exporting largely and promises to do far more for the future. The prophecies lately indulged in by Mr. Giffen, of the Board of Trade, as to the population of the United States rapidly overtaking its productive powers, were founded on statistics which were collected without a due regard to natural causes and effects. Mr. Giffen completely forgot that the exhaustion of land is a temporary and not a permanent matter. The exhausted corn land of America and Canada when left idle for twenty or thirty years would recoup itself by the natural atmospheric and chemical action, and the cultivation would recommence and repeat itself instead of being at an end as Mr. Giffen supposed. I well remember when Mr. Giffen read this paper at the Statistical Society, asking him how far he had travelled in the States before he wrote it, and he told me he had not been further than Washington. The statistics of such gentlemen are valuable studies of arithmetic, but when they are compiled without any regard to the natural causes which may entirely alter the conclusions arrived at, they are very deceptive for practical purposes. The results that I arrive at are as follow: 1st. I believe for many years to come that meat will be rather cheaper here than it has been during the past decade. 2nd. I think that all meat-producing countries will have a prosperous occupation, and I would strongly advise them to reciprocate by receiving our manufactures in exchange at a very moderate tariff, in order to prevent our finding it necessary to retaliate. 3rd. I believe that our own colonies are likely to be the largest gainers, and as they are not only our own blood, but also give to us greater reciprocal advantages in commerce than other countries, I am very glad it is likely to be so. 4th. I think that the British farmer will still be able to compete, if his burdens are equalised with those paid by farmers in other countries, and he has perfect protection from the importation of contagious disease. I only have to add that with that portion of Mr. Duckham's paper which refers to the treatment of agricultural tenants by their landlords I take exception. I believe that on the whole the English landlords have been more considerate towards their tenants during the recent times of depression than any one could have believed possible. I have no wish to deprecate the recent legislation, but I know that between most landowners and their tenants very fair compensation for improvements existed before the Act was passed, and I think that the good feeling which really exists between landlords and tenants is to be encouraged, and not to be called in question. Of course, when prices are as high as they were ten or fifteen years ago, rents have a tendency to rise, just as when prices fall, as they have done recently, they decline. This is simply a natural sequence in both instances, but the interests of the tenants are so bound up with those of the landlord that I believe any further interference between them would be mischievous in the extreme.

Lord EGERTON OF TATTON considered that the thanks of the meeting were due to the authors of the papers for the interesting facts which they had laid before them. This was a question which concerned the whole community—the consumers and the occupiers of the soil equally. He should direct his remarks principally to the way in which an increased food supply could be got in this country. In doing so he would touch upon some of the remarks in the paper, and he would just say a word on the foreign meat supply. Any one who had visited the Health Exhibition would see the Australian meat hanging up in cases, and any one who would buy a leg of mutton and try it would find it was as good as he could desire. There was, however, an advantage in home grown meat over the Australian meat, namely, that we had not yet got over the difficulty that storing meat in an atmosphere of low temperature produced hardness in the meat which it was difficult under the ordinary mode of cooking to get over. He had no doubt that with better process of cooking this difficulty might be removed, but the fact as yet remained, and it might be some consolation to the farmers to think that they might go on growing their meat without fear of competition from abroad, because there would always be a sufficient number of people in this country who would give a higher price for fresh meat than for foreign meat in a preserved state. Passing on to the question of increasing our stock, statistics had shown that in consequence of the bad seasons partly, and also of the importation of disease from abroad, our home agriculturists had been discouraged in the rearing of all sorts of stock. In his own county the damp years had almost stamped the sheep out of the country. After the cattle disease became prevalent they took to rearing sheep, and in the dry years they did well, but when the wet years came on, the sheep became diseased, and at the present time not one farmer in ten grew sheep who formerly did so. But they were now turning their attention to the rearing of young stock, and he thought this might be done now to a greater extent than before, but it should be upon a very different system. The cause of the increase in the cattle from Ireland was to be found in the fact that Ireland was the best cattle growing country in the world. It had the most suitable climate; the absence of cold in winter and the peculiar soil of the country. What they had to do in England instead of trusting to other countries for rearing stock, was to have covered yards, and to rear their own stock. That was what he had done recently. He had 500 acres in his own hands and he had done a great deal under paper sheds last winter. There was one remarkable fact about it—he had tried the rearing of cattle under sheds of slate and also under paper, and he found that those reared under the paper had done by far the best. He attributed this to the fact that the paper was warmer than the slate. He could say with confidence if these paper sheds would only last seven years, they would repay their cost over and over again. It was a very small outlay in the first place for paper, and they were perfectly portable. They all had the opportunity of seeing what it was, because the whole of the temporary sheds in that Health Exhibition were covered with paper. He must enter one protest against Mr. Duckham's paper. He thought that gentleman had taken causes of a limited character, and attributed to them wider effects than there was reason for. Three causes were mentioned why the farmers in England were not as fortunate as formerly ; the first being that the crops were destroyed by game ; the second was the cruel laws of distress ; and the third, that they had no security for the capital invested.

Mr. DUCKHAM (interrupting) said these were the minor causes.

Lord EGERTON OF TATTON said these reasons were put in the forefront, and he did not believe that either of these three causes affected Cheshire ; but he would say that the three other causes mentioned in the paper, namely, the increase of local taxation, the increased wages for less labour performed, and the bad seasons had no doubt had something to do with it.

Mr. FREDERICK BANKS (Christchurch, New Zealand) said he did not attend that meeting for the purpose of addressing it, but from what he had heard he thought it likely that the few remarks he would make would be of service in connection with importation of foreign meat from New Zealand. Having been a Director of the first Frozen Meat Company which was started in Canterbury, New Zealand, he was well acquainted with the frozen meat trade, and he might state that the public in England might depend thoroughly upon the quality of the meat imported. They had engaged one of the most experienced managers of stock in the Colony, and had given him the most stringent instructions that the sheep sent to be frozen were to be inspected very particularly, and any which he did not approve of were to be rejected—that was before they were killed. Then, again, after they were killed their carcases were to be again inspected, and any then not up to the mark were to be rejected. Hence he could say to the consumers in England that the meat imported was of the best. He did not agree with the last speaker, that English meat might be relied upon as better than frozen meat. He believed that the frozen meat would soon take the leading place in the favour of the consumers. When he visited some of the leading butchers' shops in London, he found the carcases hanging up there, the meat being in a warm state, and covered with flies; but that was not so with the imported meat. People in the Colony were fast giving preference to the frozen meat. Personally, he had kept some for three months, and then had had it properly thawed and put on his table, and both himself and his visitors gave it the preference over meat killed in the Colony. There was another matter of importance alluded to by Mr. Harris, who stated that arrangements were being made for distributing the meat throughout England. He had been down to the docks himself, and had spent nearly a day looking at what was being done in this direction. He had hoped that in a city like London things could have been done far better than they could do them in the Colony, but he saw the meat landed and placed on trucks which had been used for other purposes. Now, in the Colony they had special trucks constructed for sending this meat about in, and he did not think the trucks used by the Dock Company were at all suitable for the work. It would tend to send the meat to the consumer in a state that was hardly fair to the imported meat. The whole thing was very simple, but the system of doing it was a haphazard one, and the importance of doing everything in the best way was not considered. The trade was in its infancy, and had not yet been worked in a way which practical men would work it. It needed improvement considerably. Then again it was said that their charges were moderate. Those in the Colony did not think so; they thought they were excessively high. It was true the Dock Company were making chambers for the reception of the frozen meats, and had very nice engines and apparatus for keeping it frozen, but he thought they were attempting to pay for all this in the first year or two, instead of allowing it to be distributed over a period of years, and he hoped that they would soon modify their charges. Mr. Harris had said that a penny per pound was a moderate charge ; but he considered it very heavy. A sheep in New Zealand would be worth 18*s.* for a 72lb. sheep, and a penny per lb. would equal 6*s.*, which was at once one-third of the cost of the sheep ; he considered that that was too heavy a charge altogether.

Mr. HARRIS, M.P., said he was very glad to have heard this gentleman's remarks, but it must be remembered that the Dock Company with which he was connected had only just commenced ; he would represent to his brother directors what had been said, and if some cheaper way could be devised he should be very glad. At the present time they did not make much profit out of it, and they must, however, first of all pay themselves.

Mr. BANKS said he was very pleased to hear Mr. Harris's interpolation, but he thought practical men would make suggestions which would be useful to the Dock Company. He had himself seen a small army of men waiting idle to receive the meat from a steamer that was discharging. These men had the ordinary trucks that had been in use for perhaps a century past. If he had been asked what to do instead of using these trucks, he would have said, have a small travelling railway, and two or three men could then do the work which it would take twenty men to do with these trucks. These things could not be improved and worked up to in a day. He was, however very glad to hear Mr. Harris say that it was the intention to try and improve matters as far as possible.

Mr. C. H. LATTIMORE said he ought to apologise for taking up time any longer after the wearisome discussion they had had, but it did seem as if the last speaker was such an advocate of New Zealand frozen meat that he thought that there was nothing else in the market equal to it. For his own part, he would leave that question to the house-wives of England, and to those who consumed the meat, for they were the best judges; but they had so many advocates of frozen meat just now, that you might have thought it was a privilege to be born to eat it. They had met to discover how to increase the amount of home-grown stock. This question was brought forward as if this disease and diminution of stock was a thing of yesterday, but it had been going on, to his own knowledge, for at least forty years. Disease came in a slow but a steady manner; it followed the trains and the fairs of the country. Farmers could never buy imported cattle without a risk of foot-and-mouth disease. A hundred sheep could not be brought from the north to the south without falling lame, and depreciating in value. The grazier's occupation was gone in this country, for he could not buy good raw material, and when it was bad it was liable to disease, and when he brought it into market, he met with these New Zealand gentlemen, who came in with their frozen meat, and tell you there was nothing like it. What was wanted was to increase first the quantity of store stock. There were two means of doing so: to improve the condition of the farmer, and to keep out foreign disease. The cause of the diminution of English stock had been going on, to his own personal observation, gradually but surely, and it had come to this—that meeting the vicissitudes of uncertain seasons, floods, and foreign disease had knocked down many a farmer, and destroyed his portion of the stock. Others had been diminished and limited in their quantity, and the result was that foreigners sent in no foreign stored stock. Therefore it was necessary to improve the position of the farmer, to keep out the disease, and for the landlords to give the farmers security and encouragement. With respect to the quality of the stock, it was possible they might so improve it as to come up to the standard even of the New Zealand meat. He did not think that the abolition of the malt duty in England had been taken sufficient advantage of. Malt was one of the finest articles to improve the quality of meat, and when they got it fairly into use, he believed it would increase the supply of stock, which would improve the condition of the farmer to a very sensible degree. Then with regard to pasture land, what was the position ? The low price of wheat had driven men to abandon its growth, and land was laid down in pasture ; but what would that land produce ? It would not give the same quantity of meat as if root and corn crops were combined. Give him stock and corn together, and that would cope with all the competition in the world. Now the proportion of wheat grown in the country to that imported was in the last few years as 9 to 25 ; taking the consumption at 25 millions, and we produced only 9 millions, and he believed there would be still less. The proportion of meat grown here was 90 to 10. They had been told that disease was not introduced from abroad ; that it was indigenous to the soil and to the stock in this country. He denied that. Mr. Harris had told the meeting that they had no disease where they had no importations. He warned the meeting that whatever they might think of the foreign meat at the present time, when the foreigner felt that he could hold the market he would raise his price, and the consuming public would be thrown on the mercy of the foreigner ; but he would tell them that—

> " Self-dependent power can time defy,
> As rocks resist the billows and the sky."

The Conference resumed at 2·30, when Colonel Kingscote, M.P., took the chair, Lord Suffolk having been called away.

HOME-GROWN MEAT SUPPLY AND THE INCREASED PRODUCTION OF HOME-GROWN MEAT.

By John Clay, Kerchesters, Kelso, N.B.

In dealing with this most important and national question there are two vital points to be considered, and these are—*first*, The causes of the short supply of home-grown meat ; and *second*, The remedy for its increase and further development.

It is not my intention to do more than merely allude to some of the more prominent causes of the short supply in this Paper, because I understand that another Paper entering fully into that subject is to be read to you. I will, therefore, only mention here what appears to me to be the principal causes of the falling off in the supply of home grown meat before proceeding with the remedy.

There can be no doubt that one of the chief causes of the diminished supply of home grown meat has been the contagious diseases, such as "rinderpest" and "foot-and-mouth disease," from which our cattle and sheep have suffered so much of late years.

The bad seasons which have been experienced for the last ten or twelve years have likewise had a very injurious effect, for the wet summers have kept the grass from being nutritious to stocks in general, and have also caused fatal disease amongst sheep ; whilst the severe winters and cold summers have greatly curtailed the food supply of stock.

These causes alone have undoubtedly had the effect of diminishing the average yield of beef and mutton per acre over the whole country of late years.

It appears to me also that sufficient attention has not been paid to the breeding and rearing of cattle in this country for the last twenty years, which is chiefly owing, I believe, to the risk of the introduction of contagious diseases such as the foot-and-mouth disease, to the breeding stocks, and the great losses which the breeders sustained by the importation of disease from abroad.

With regard to the *second* point, viz., the remedy for increasing the supply of home-grown meat, it appears to me that the first thing which should engage our attention is the production of a greater supply of stock by breeding, for that is the only method by which stock can be increased. It should be made a rule with farmers in this country never to sacrifice a good heifer to the butcher until she has produced at least two calves. On the great cattle breeding ranches in America, which I lately visited, this rule is in constant practice, and I am glad to say that in one or two districts of this country the farmers are alive to the value of keeping up a good breeding stock, for in Cumberland and Westmoreland, when cast cows are sold for dairy purposes, the vendors generally stipulate that all heifer calves shall be returned to them by the purchasers—no doubt for breeding purposes.

There are two methods which may be successfully pursued for increasing the supply of stock on arable and pasture farms, and these are : first, when the farm consists of partly arable and partly good pasture, with outlying rough grass-land, by the keeping of a herd of heifers and suckling the calves ; and, second, where the farm consists of ordinary arable and grass-land, by the rearing of calves by the hand.

As an example of the first method, I may be allowed to describe the system which I have myself pursued for many years past, and which has enabled me to produce as much stock as have been required for feeding purposes on my two large arable farms. I keep a stock consisting of 150 Shorthorns, and Polled Galloway, breeding heifers, partly on my hill farms, and partly on my arable farms, and these heifers are put to the finest pedigree Shorthorn bulls which I can get. These heifers are divided into three classes, with reference to their ages. First, 50 one-year olds, which are put to the bull at about 15 months old, and produce calves in their second year. Second, 50 two-year-olds, which have had one calf, and produce calves in their third year also. The steer and heifer calves of these two classes are all retained on the farms, the heifers for breeding and the steers for grazing, and afterward feeding. Third, 50 three-year-olds which have produced calves in their second and third years, and will also produce calves in their fourth year. The calves of this class in their fourth year are suckled by their mothers in summer on the best quality of grass-land, and in winter the calves and their mothers are brought into the cattle-courts and feeding-boxes. Here, they are liberally supplied with turnips, meal, and cake, and they are both fed off together and sold to the butcher in the following spring. The cows managed in this way fatten well, averaging about 65 stone, and the suckling calves average in weight about 40 stone, of 14 lb. to the stone, at 14 or 15 months old, and are sent to the market at the same time as their mother.

With regard to the second method, viz. the rearing of calves on ordinary arable farms by the hand. Formerly it used to be the custom to bring up more calves on farms by the hand than what are now reared, and calves for this purpose could be more easily and cheaply obtained than now, for in the border counties nearly every farm-servant and many villagers kept cows, the villagers having grazing in the neighbourhood of the village. About twenty years ago a movement took place on the part of many of the servants, and also on the part of many of the farmers, to substitute money payments in the place of the keep of the servants' cows, and this considerably diminished the number of cows kept in the district, the consequence of which was that fewer calves were bred. The demand for veal, which had been gradually increasing, became greater than the supply, and it was found to be more profitable by the farm-servants who still had cows, to feed the calves, in a few weeks for veal, than to sell them to the farmers for keeping stock. My own practice is to supply all my servants' families with cows of my own, to enable them to keep their families supplied with good milk, on condition that for the loan of the cow I receive the calf yearly. I find this to be not only a profitable arrangement but it is also a good one for the servants, and it gives me a supply of calves for rearing by the hand, which I could not otherwise obtain.

If landlords could arrange to supply each village on their estates with a grass park for the grazing of cows, making a charge of so much per head for each one grazed, in place of the common grazing land which, in most instances, the villagers formerly enjoyed, it would not only increase the number of stock obtainable for feeding purposes, but also tend to make the villagers more comfortable and healthy, and better satisfied with their position of life than at present.*

A certain number of cows are required on every farm, and I would advise that as many as possible should be kept, so that they may produce calves for the supply of feeding stock. My experience is that with the use of calf-meal and other ingredients the milk of one cow can now be made to go further in the bringing up of calves than formerly; and I have no doubt that with a little extra attention and care nearly double the number of calves could be reared upon each farm than at present. No doubt there are certain high-class farms upon which it will not pay to keep cows, but those are the exception and not the rule; until more attention is paid to the rearing of calves by our farmers, this country must continue to suffer from a deficiency in the supply of home-reared cattle for feeding. With reference to the subject of feeding, there are several points to which I would wish to allude, and these are, 1st, Summer-feeding; 2nd, Winter-feeding; 3rd, Accommodation in Farm-Buildings for Feeding Cattle; 4th, Increase of Sheep; and 5th, the General Cultivation of the Farm.

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* I would strongly recommend all who are interested in this subject to study Mr. Henry Evershed's able paper on "Cowkeeping by Farm Labourers," in the 'Journal of the Royal Agricultural Society' for 1879 and 1880.

1. *Summer Feeding.*—At the present time the usual method is to turn the cattle out into pastures in early summer, where they remain without any other food but the grass until the autumn, when they are taken into the cattle-courts or sold for feeding. In many cases the grass is not of sufficient quality to keep the cattle in an improving condition, especially for the last few years, owing to the cold and wet seasons and the gradual deterioration of the condition of the land. A remedy for this is the supplying of the cattle on the grass with cake and other feeding stuffs, for these not only fatten the cattle, but also greatly improve the condition of the pastures. The soiling of cattle, by which is meant the supplying of cattle in courts with cut grass and other green food such as beans, peas, or tares, &c., is coming more into use, and by this mode of feeding along with the liberal use of cake and meal the cattle are speedily and profitably fattened for the autumn markets; and where there is a superabundance of straw it is a valuable mode of converting it into manure of the first quality for the farm. More attention must also be paid to the laying of land to permanent pasture, where it is found that the cultivation of cereals is not remunerative. It is becoming more and more apparent that the farmers of this country cannot successfully compete with countries such as America, India, and Australia in the production of grain crops. Any one who has seen the vast extent of the wheat producing countries in America, and is acquainted with the cost of carriage of grain from there to this country, must be convinced that the more the British farmer turns his attention to the breeding and feeding of stock the better will he be able to hold his position; for it is admitted that he has a considerable margin of profit in this department when in competition with the foreigner, for that eminent agricultural authority Sir James Caird, in his Report on British Agriculture, published in the Journal of the Royal Agricultural Society of England for 1878, states that, "under any circumstances, the English producer has the advantage of at least a penny per pound in the cost and risk of transit against his transatlantic competitor, an

advantage equal to £4 on an average ox; of this natural advantage nothing can deprive him, and with this he may rest content." The ordinary cereals of the farm might in many cases be more profitably employed in the feeding of cattle than by the disposing of them in the usual way in the corn market; and it appears to me that a great omission in the Agricultural Holdings Act is the want of a clause to give compensation to farmers in the event of their using their own grown corn for feeding purposes on their farms, and it is the interest of all concerned that this omission should be speedily remedied by the legislature of the country, so that the tenant farmer may with freedom use the cereals grown upon his own farm for feeding purposes, and the production of beef and mutton for the market, and thereby not only benefit himself but also increase the fertility of the farm.

2. *Winter Feeding.*—It is well known to all practical farmers that the better the condition in which cattle are when they are brought into the cattle-courts from the grass, the sooner they take kindly to their new quarters and begin to lay on beef. There are several modes of feeding in use. Some farmers give the cattle a full supply of white turnips as soon as they are put into the courts, and nothing else. The cattle do not improve satisfactorily when they are subjected to this system of feeding, and a much better plan for fattening the cattle and economising the use of the turnips and green crop on the farm, is to give the cattle a very limited allowance of turnips to begin with, when they are newly taken into the courts, along with a supply of cut hay and straw, mixed with a little meal and cake. After the cattle have become accustomed to their new diet and winter quarters, the allowance of turnips can be increased with benefit. The general experience of farmers is, that it is much more profitable to employ fewer turnips and a larger proportion of meal and cake, &c., in feeding, than they used to do. My own mode of feeding is to supply the cattle sparingly with turnips when they are first brought into the courts from the grass, supplementing the

turnips with dry food in the shape of cut hay and straw, meal, and decorticated cotton cake. After they have become accustomed to the change of diet, they each get an allowance of about 84 lbs. of sliced turnips, with 4 lbs. of decorticated cotton cake in a dry state, also a mixture of steamed cut hay, barley, and wheat chaff, meal, treacle, and linseed oil, with a little salt. Of this mixture each animal is allowed as much as it can eat. When the cattle get nearer the butcher, the supply of turnips are increased to 112 lbs. per day. With an allowance of good linseed cake, the steamed food is also made richer in meal, &c. The animals not only eat the mixture greedily, but it soon tells favourably upon their condition ; and I find that by adopting this system I can feed a greater number of cattle profitably, and turn out a larger supply of beef to the consumer than by the old system. It may also be remarked that the manure made from this system of feeding is much more valuable than where turnips form the main food of the animals, and the condition of the farm is thereby improved. Pulping turnips has been found by some farmers to be of advantage, but, as a rule, the expense and the unsuitable accommodation of many farm buildings, with the cost of labour, militates against its general adoption.

With regard to the subject of silage as a feeding material, I have not had sufficient knowledge to speak with authority upon it, for it has only recently been introduced to the country, but from the perusal of Mr. Jenkins' exhaustive report on the subject in the 'Journal of the Royal Agricultural Society' of England for 1884, it appears to me to be likely to form a considerable adjunct to the feeding materials of the farm where turnips and other feeding roots cannot be profitably grown. It will, in my opinion, be more valuable to the dairy farmer and our young wintering cattle than to the stock feeder.

3. *The Accommodation of Farm Buildings.*—Without suitable accommodation, in the shape of improved farm buildings, it is impossible to feed stock profitably. Many

of the proprietors in the border counties have been so liberal as to supply their tenants with the best accommodation for this purpose, by erecting covered yards, and well-sheltered courts and feeding-boxes, which have been constructed on the most improved principles to economize labour and food ; for it is found by experience that comfortable quarters have a most beneficial effect on the feeding of cattle, and the increase of the supply of beef. My experience on this point is, that when suitable and comfortable accommodation for cattle-feeding is provided, there is a saving of labour, and an increase in the production of beef of something like ten per cent. over the old method in open, unsheltered yards. It would be wise of all landlords who have not already turned their attention to this subject of covered yards and comfortable courts to do so without delay, as the tenant-farmer who suffers from a deficiency in feeding accommodation cannot carry on the profitable production of beef, nor give the consumer the utmost quantity which he could produce under more favourable conditions.

4. *Increase of Sheep.*—Having dealt with the subject of beef, I would now wish to make one or two remarks on the subject of the production of mutton. Of late years there has been a most serious falling off in the number of sheep in this country, there being no less than nearly four millions fewer at the present time than there were in 1879. This deficiency has been in a great measure caused by the ravages of fluke and of foot-and-mouth disease, combined with the effects of the recent severe winters in Scotland and the North of England. As much attention as possible should be paid to the breeding and feeding of sheep, in order to increase our supply of mutton. The drainage of our pasture, and the more frequent use of lime and bones on grass lands for sheep, is also a subject which requires every attention. I am convinced that with more attention to the breeding, feeding, and general improvement of our stock on both arable and hill farms, and also by our increasing the quantity and quality of our grass and root

crops, we can produce a much larger supply of mutton for the market than we do at present. Sheep cannot be confined to a limited supply of turnips in the same way as cattle, but a liberal use of our home-grown corn and cotton and linseed cake will enable us to keep many more sheep per acre than we do at present. The use of these feeding materials, in addition to the turnips, is one of the very best systems for improving our pastures and the general fertility of our farms. The more feeding-sheep that can be kept on a farm per acre, the greater will be the profit to the farmer, and the better will the fertility and condition of the land be maintained.

5. *The General Cultivation of the Farm.*—The production of beef and mutton, according to the large or small production of food produced per acre from grass or root-crops, as to the increased quantity to that of increased food that you can grow per acre, and also the more comfortable, warm and clean you can keep the animals, so will be the after turn-out of beef and mutton for the consumer, and considerable profit to the producer. The quality and quantity of an article is just in accordance with what you put into the manufacturer's hands to produce that article; put inferior wool in, you get inferior cloth out; so with the manufacturer of beef and mutton—quality and quantity, according to what you make the land produce. There can be no doubt that the maintaining of our farms in high condition is the very foundation of their meat-producing powers, for unless grass-land is laid down in high condition, and maintained so by the use of cakes and feeding stuffs consumed upon it by cattle and sheep, it very soon becomes deteriorated. The present circumstances of agriculture in this country, and the low price of cereals, with the small prospect of improvement on that price, and the expense now involved in their production, forces me to the conclusion that it will be more profitable to increase the acreage of green crops on farms for the future, and also to lay more land down to permanent pasture. Mr. Faunce de Laune, of Sharsted Court, Kent, deserves the very greatest credit

for the valuable papers which he has published on the subject of the laying down of land to permanent pasture, and he has proved by experience that good perennial pasture can be much sooner produced by the use of perennial grass-seeds without any mixture of rye-grass, than by the old system of laying down with so large a quantity of rye grass-seed. *Every landlord and farmer* interested in the laying down of land to permanent pasture should study Mr. Faunce de Laune's papers, and also, if possible, pay a visit to Sharsted Court, to see the results of Mr. De Laune's practice. I would also direct general attention to the result of the researches of the celebrated Sir John B. Lawes, which are of incalculable value to agriculture. In conclusion, I may add that it appears to me that, unless landlords and tenants bestir themselves to keep our agricultural practice advancing with the times, so as to enable us to meet the competition from abroad and the altered condition of agricultural matters generally, the value of land for farming purposes must continue to fall. The sheet anchor of the British farmer is now the increased production of beef, mutton, and dairy produce, and with energy combined with skill, the co-operation of the landlords, and the rent of land so adjusted as to give the tenant farmer interest for labour and capital invested, I am confident that he will yet be able to hold his own against the foreign producer.

DISCUSSION.

Mr. THOMAS BELL said, to him the most striking fact brought out by the paper was, that whilst our population had been rapidly increasing, the home supplies of meat had been steadily decreasing ; and the question to which attention ought to be turned most especially, was how to remedy this evil. Many causes had been referred to, the importation of foreign diseases being one of the principal ; but another, to which sufficient importance had not been attracted, was the effect of the seasons of extreme wet and drought. The wet seasons had had the effect of developing the fluke disease amongst the flocks, and the result had been that millions of sheep had been destroyed ; on the other hand, the effect of drought was, though not directly to kill the sheep, to cause a very large number of them to be prematurely slaughtered ; and, consequently, the prospect of a future home supply was materially diminished. He had some hopes that the system of ensilage would assist in tiding over these seasons of extremity. He had been much surprised to hear Lord Egerton question the statement made by Mr. Duckham, that the want of security for farmers' capital invested in the soil had limited the produce considerably. Surely when the Legislature were convinced that an Act of Parliament was necessary to give increased security to the tenant for the very purpose of increasing the produce—and there could be no other reason why Parliament should intervene—that was a sufficient proof of the accuracy of Mr. Duckham's statement. Again, Mr. Duckham had also referred to ground game and the law of distress, and what he had said in regard to them was also proved in the same way, for Parliament had recently passed laws for the very purpose of modifying those evils. He had also been surprised to hear Mr. Harris say that rents, instead of being too high, were too low. He was the more surprised to hear him say that, immediately after he had told them that the result of steam and cool chambers had brought the produce of the most distant countries to England at almost their cost price. Surely, if the produce of the soil of those countries were to be equalised, the value of the soil that produced those products must, to a certain extent, be equalised also. The law of supply and demand would regulate the price of land, as it did that of all other countries. He had also some hopes that we should soon be rid of foot-and-mouth disease, and there would assuredly follow an increase in our home-bred animals, with a better supply of meat to the consumer, possibly at a lower, but certainly a more regular price, which would bring greater profit to the producer.

Mr. MALLOWS, referring to the observation of Mr. Duckham, that the British agriculturist showed want of energy, said that he might be cast down, and might be hard pressed, but he thought the British farmer was an Englishman still, and would not lack in anything. Mr. Duckham had lamented over a loss of 5 or 6 million sheep to the country, and he quite agreed with him on the point. He knew what the fluke was, and what the foot-and-mouth disease was, which had taken off hundreds; but there was another disease in the country from which he came—West Suffolk—which was still worse, and that was the low prices. Many had been obliged to sell half their sheep to pay their way, so that in fact now the keeping of sheep was a luxury, which only a few men in that county could afford, owing to the price of corn being so low, that he was a lucky man who could pay his expenses. Rather than sink, they would sell off their sheep and cattle, and they had not money to buy them back again.

Mr. MITCHELL HENRY, M.P., could not help congratulating his friend and former colleague, Mr. Clay, on the extremely practical and encouraging Paper he had read. All agriculturists, whether in Ireland, England, or Scotland, had suffered greatly from imported cattle disease; Ireland, however, as they knew, had been spared the infliction of the cattle plague, or its condition would have been far worse than it was. He thought great encouragement might be drawn from this circumstance, that great improvement in the hygienic conditions of human beings, owing to greater knowledge, had greatly increased longevity, and where epidemics arose they were much better dealt with than in former times. He thought agriculturists might follow the same lines. He was not anxious they should believe that it would ever be possible to entirely stamp out epidemic disease amongst cattle; by better regulations they would no doubt be reduced to a minimum, but they could never hope to be entirely free from diseases. At the same time they could do a great deal towards strengthening the animals which were subjected to them. Every one's observations showed that if you had healthy parents, and took good care of the young, seeing that they were well sheltered and well fed, and protected from the influences of cold, and, what they were better able to withstand, the attacks of disease. It was a marvel to him how many cattle, especially in Ireland, lived at all. In many parts they were driven out into the open from their earliest days, and there they remained without hardly anything to eat, and there they were sold in the fairs, and brought either into the feeding grounds of the middle parts of Ireland, or to this country, where, for the first time, they tasted really nourishing food. His farming was almost entirely on land reclaimed from the waste, and as the result of twenty years' work, he could say that he could rear cattle, not finish cattle, as profitably and as healthy as were to be found in any part of England, Ireland or Scotland, simply by adhering to the common-sense principles which had been laid down so ably by Mr. Clay. It was necessary to learn this lesson, because now that the Bill for putting further restrictions on the importation of disease, which he had always supported, was passed, they ought to turn their attention to other matters. These diseases might be stamped out, but they would never be got rid of unless cattle were fed and housed differently to what they had been. Mr. Clay's paper, was, therefore, an encouraging antidote to some of the rather alarming though very useful statistics of Mr. Duckham. They had lost millions of sheep and vast quantities of cattle, but happily they were beginning to recover them, and if they only learnt a lesson from what had passed, and took better care of the young and sheltered the elder ones, and paid more attention to the breeding of cattle, all their difficulties might yet be surmounted.

Mr. SHOOLBRIDGE (Member of the Legislative Assembly of Tasmania) said he came there as a perfect stranger, having only just come from Tasmania. His father, who was a farmer in Kent, left England in 1821, and he had been in Tasmania ever since. It was one of the finest climates in the world, and formed part of the British dominions; it was eminently calculated to support a vast population, and afford a supply of food to an over-populated country, such as England appeared to be. The suggestion he would offer was that the sons of practical farmers in England should go there and occupy lands which were becoming now comparatively useless for the want of labour. The means of bringing the meat raised there to this country were now such that it could be brought at a very nominal price. He spoke from experience, his whole life having been devoted to agricultural pursuits, though recently he had been growing principally hops and fruit. When he came away he left over 800 people picking hops on his land, and he had adopted for years past the plan Mr. Clay had recommended, of supplying his work people with a cow; there were over 100 cottages occupied by his people, every large family had a cow, they had their gardens and their pigs, and he considered the calves he got in return an ample recompense. The returns from agricultural pursuits were more certain in Tasmania than any other part of the world. He had just spent six weeks in America, and it appeared to him that it did not compare for one moment with Tasmania as a home for English people. Every one who went to that colony still remained a British subject, a friend, and a brother of those he left behind; and there was no place in the world where he could get so comfortable a home, or find such good land, which could be purchased from the Government at a low price, with a long period for payments. Some time ago Sir Henry Lefroy, the late Governor, wrote to him a letter by the hand of a practical farmer who wished to settle there. He had employed him, and he was gaining colonial experience, and learning how to cultivate the land. He had already purchased a piece of Government land, and was about to employ other men to go and clear it for him, and make it ready for his future home. He could bring forward hundreds of similar cases. Tasmania was especially adapted for rearing stud-stock for the neighbouring colonies, and it was no exaggeration to say that they got from 50*l.* to 500*l.*, or even 1000*l.* for a stud sheep. He believed that would continue to perpetuity, inasmuch as the other colonies were much hotter, and had neither the climate nor food so well adapted for rearing good stock. They were now introducing blood-stock into New South Wales, Queensland, and Victoria. It was thought some years ago that that land would not do for sheep, but Sir Roderick Murchison settled that, for he showed that it was at a higher latitude than other land of a similar climate, and the wool did not deteriorate into hair; it did deteriorate to a certain extent, and for that reason those other colonies constantly required stud stock from Tasmania to keep up the quality.

THE MEANS OF SECURING THE SUPPLY OF MEAT TO LARGELY POPULATED CENTRES.

By S. B. L. DRUCE, Barrister,
Secretary of the Farmers' Club, London.

THE last paper which it has been decided should be submitted to this Conference is by no means the least important; for however much the British and Irish farmer may increase the number of his live stock, and however great may be the production of live stock in foreign countries, it is, comparatively speaking, of little interest to the mass of the population of the country, unless the means exist by which that Home and Foreign Stock can be brought to the consumer in good condition and at a reasonable cost. And this problem is every day assuming greater proportions, because of the vast rate at which the population of the large towns of this country is increasing. Above all places, this is true of London, for there the population has of late years increased, and is still increasing at such an enormous rate that there are now about 4,000,000 persons in it, the population of a country rather than of town. And this vast population, or at all events the greater part of it, requires to be supplied with meat, and that meat must be fresh and good. It is indeed wonderful, when one thinks of the requirements of London, that it is supplied with meat as well and as economically as it is.

I propose in this paper—the preparation of which I regret should not have fallen into the hands of some one more capable of exhaustively dealing with the subject than I am—in the first place, to put before you as minutely as I can the modes by which London and our large towns are now supplied with meat, and in the second place to consider whether those modes of supply may be improved, and if so, how. My observations will refer to London more than to our large provincial towns, for it is the supply of London that has especial interest, not only to us who live in the Metropolis, and are consumers of the meat that is supplied to it, but also to very many of our farmers who send up the meat they manufacture for sale in its vast markets. Nor, indeed, have I been able to lay my hands on any official statistics, if there are any, of the quantities of meat that are consumed in the large provincial centres of population, such as Liverpool, Manchester, Birmingham, Leeds, &c.

Our sources of supply are two—Home and Foreign—and each of these sources comprises two distinct classes: (1) Live animals and (2) Dead meat. I propose in the first place to consider our Home supplies, which, as has been so clearly pointed out by my friends, Major Craigie and Mr. Duckham, in the papers they have read before you this morning, are so vastly in excess of, and therefore of so much more importance than our Foreign supplies; and first, of the live animals which our British farmers send to our Metropolitan markets. In order to understand and realise this part of the subject, let us trace the history of a single bullock from its birth on a breeding farm until it, or rather a part of it, reaches the actual consumer. Our calf, we will suppose, is born in one of our breeding counties in the West of England—let it be a Devon from Devonshire, a Shorthorn from Gloucestershire, or a Hereford from Herefordshire. The farmer who breeds it keeps it till it is some eighteen months or two years old, during which time, after it has been weaned, it has eaten but little more than the natural food of the district of its birth. At two or two and a half years old it is bought by a dealer, and forms one of a drove, which is sold, perhaps after it has passed through more than one intermediate purchaser, to, let us say, a Leicestershire or Northamptonshire grazier, who lets it run on the rich pastures of those favoured counties, and when it has become fat and ripe for the butcher, from feeding on the luxuriant herbage those pastures produce, assisted perhaps with artificial food, the bullock is sent to the Islington Market consigned to the London cattle salesman; or instead of passing its summer in happy contentment on the Midland pastures, our bullock is taken in the autumn of the year to Norwich Hill, and there sold to a Norfolk farmer. In this case the animal, after having been comfortably housed in a Norfolk farmyard, with its good deep sheds to shelter the stock from the cold winter winds, but with an open space in which, when the sun shines, the stock may luxuriate in the warmth; and after having been well fed with the best of hay—may I say "Ensilage"—roots and artificial foods, finds its way, as in the former case, to the Islington Market and the London cattle salesman. In either case it is brought up by train to the Islington Market, and the cattle salesman sells it in that market to the wholesale meat salesman. The cattle salesman charges the Leicestershire or Norfolk farmer a commission on the sale, and, deducting that from the price he receives, pays the farmer the balance. So far, then, five, if not six persons have made, or expect to have made, profits on our bullock since its birth—first, the breeder; second, the drover; third, the grazier, summer or winter as the case may be; fourth, the railway company, or companies, who have carried him perhaps to the grazier, and certainly from the grazier to the cattle salesman; and lastly, the cattle salesman himself. But the bullock has yet by no means reached the consumer. The cattle salesman sells him to the wholesale meat salesman, who perhaps sells him direct to the family butcher, who himself slaughters the bullock, and sells his carcase by retail to the actual consumer; or, as is far oftener the case, the wholesale meat salesman slaughters the bullock and sells the carcase to the retail butchers in the Smithfield Dead-meat Market—the best parts of it, the "prime," as it is called, to one class of such retailers, the inferior parts to others. For every part of the carcase—the prime, the inferior, and the offal—finds ready purchasers in London, and no part is wasted. The retail butchers at last, whose carts we may see in the early morning being driven from Smithfield to their shops in the various parts of the Metropolis, cut up the carcases or half-carcases which they have bought in that market, and sell them in joints—"ribs," "sirloins," "silversides," "aitchbones," "pieces for gravy," &c., &c.—to the actual consumers. Here we have two more profits, those of the wholesale meat salesman and the retail butcher, to add to the five or six before enumerated. Thus, altogether at least six, and more commonly eight, profits have to be made off our bullock before the unfortunate consumer, out of whose pockets, be it remembered, all these profits come, is able to place his joint of beef on his table.

Leaving for the present the consideration whether it is necessary or expedient that all these stages, and consequent profits, between the producer and the consumer should exist, I pass on to consider the number of live animals that our own country sends to us in London. These numbers are given annually in the agricultural returns, and for the following years were as follows :—

Year.	Cattle.	Sheep.
1864	218,894	1,196,411
1874	186,992	999,185
1881	165,920	628,030
1882	156,665	514,490
1883	124,730	465,450

I omit the pigs because they are, comparatively speaking, but few in number. The number of cattle and sheep sent alive to the London Market shows, it will be noticed, a decided diminution during the last few years. Two causes account for this—(*a*) the diminished number in the country, and (*b*) the increase in the home dead meat trade.

Secondly :— How is the home dead meat brought to London, and in what quantities is it brought ? The dead meat from our own country is brought to London mainly, but not entirely, by the railways, for two shipping companies bring some dead meat from Scotland. Of the railways, the London and North-Western and the Great Northern bring by far the greater portion. These two companies, indeed, pay about half the total amount of the tolls which the various railway companies having termini in London pay to the City Corporation for the dead meat which they convey into the Central Meat Market for sale. A part, perhaps, of the quantity which the former of these companies brings to London may be American, which has been taken from shipboard at Liverpool, but this is only a small part, and by far the largest part, indeed almost all, is brought from Scotland and the various parts of England served by the two companies I have named. This meat is brought in vans specially constructed for the purpose, and is delivered, as a general rule, in good, sound, and healthy condition. From the reports of the Central Markets Committee of the Corporation of London, we find that the supply of country killed meat was 101,643 tons in 1882, and 106,391 tons in 1883; and that in each of those years it constituted very nearly one-half of the whole quantity of dead meat supplied to the Metropolis through those markets, which was in 1882, 211,461 tons; and in 1883, 223,085 tons. The increase in the supply of the home dead meat brought to London is very apparent from the statistics of the tolls which the railway and shipping companies pay to the Corporation for such supply. The authorized toll is one farthing for every 21 lbs. of weight, and this, on the home dead meat, produced in 1869 (the first year when the Central Market was opened)

	£7,172	from the	Railway	Companies
	221	"	Shipping	"
In 1874	£9,619	"	Railway	"
	113	"	Shipping	"
In 1882	£10,763	"	Railway	"
	402	"	Shipping	"
In 1883	£11,321	"	Railway	"
	410	"	Shipping	"

or an increase per cent. on the first year of 31 in 1874, and 51 in 1882, and 58 in 1883.

II. The Foreign Supply.

I divide this into two divisions, just as I divided the Home Supply, that is to say—

(*a*) The Live Animals.

(*b*) The Dead Meat.

As you are aware, all the foreign live animals, whether intended for the supply of London or other part of the Kingdom, must by law be landed at special Foreign Animals wharves or markets. In the case of London, this special market is that at Deptford, though it does not follow that all the animals that are landed at that market are consumed in the Metropolis; some of them supply other parts of the country; but still, the majority of the foreign animals that are landed at Deptford undoubtedly are consumed in London.

Deptford Market belongs to the Corporation of London, by whom it was established in the year 1872, for the purpose of carrying out the provisions relating to foreign animals contained in the Contagious Diseases (Animals) Act, 1869, which Act was passed because of the outcry which was raised in the country against the unnecessary risk to which our home stock was subjected when it was brought into contact in the same market with foreign stock. Deptford Market is well and suitably built, and, like every official institution of the City of London, is well maintained, well kept up, and well conducted. The area of the Market covers some thirty acres. On one side it abuts on the Thames, on its other three sides it is completely walled in. On its river side are piers and wharves. It comprises lairs and abattoirs, as well as ordinary sheds. It has its offices and houses for some of its officials within it, and, one may say, is complete in itself. Its ventilation is good, its drainage admirable, and its water supply excellent—hot and cold water being laid on in abundance, with convenient taps for its use.

As in considering our home supply of live animals we have taken the case of the bullock being brought to the Islington Market, so in considering the foreign supply of live animals let us suppose a vessel to arrive at one of the piers of the Deptford Market. In the first place, no persons except the officers of the Market are allowed on either the landing stage or the vessel itself, and the men who are so allowed are dressed in waterproof leggings and smocks, which are always disinfected after use. Before a single animal is permitted to be landed from a cargo, the whole cargo is inspected beast by beast by the Veterinary Inspector or his deputy. If the cargo is healthy, the animals are at once driven into the lairs in the Market; but if any animals are found in it suffering from foot-and-mouth disease, those animals are taken directly into special disinfected slaughter-rooms (not the ordinary abattoirs), and there slaughtered. The flesh of animals suffering from foot-and-mouth disease is sold for food, but the hides and offal of such animals are wholly and effectually destroyed by being boiled down in huge steam tanks with the most powerful disinfectants known to chemistry. And the carcases of animals suffering from more serious diseases are treated in the same way—that is to say, they are boiled down, and so wholly destroyed. "Suspects," that is, animals not actually diseased, but which, from contagion with diseased animals, or otherwise, may become diseased, are placed in separate lairs, and carefully watched till they are killed. All beasts are slaughtered, as a rule, within ten days of being landed. A fortnight, it is said, is an exceptionally long time for a beast to be kept in the Market. The hides, horns, fleeces, and offal of all animals, no matter how healthy the animals may have been, and also all manure and spoiled litter, are carefully disinfected with carbolic acid and lime before they are taken away from the Market; and the latter are shot into lighters at one special pier, and each load is sprinkled with quicklime.

The Market is large enough to accommodate some 4000 bullocks, besides sheep and pigs, at one time. The actual number of foreign cattle and sheep that have been landed at it in the following years is as follows :—

Year.	Cattle.	Sheep.
1872 (1st year)	38,426	122,601
1882 . . .	128,676	783,449
1883 . . .	126,510	734,911

(*b*) The *Foreign Dead Meat* supply.

In the preparation of this part of my paper I have been very materially assisted by information which has been supplied to me by one of the best authorities (Mr. H.

Moncreiff Paul, F.S.S.) in reference to the trade in Australian and New Zealand frozen meat, who on this particular question says:

For some years attempts, more or less futile, were made to solve the problem of bringing from the Australasian shores to the markets of this country, fresh meat in carcase, in a thoroughly marketable condition. With the arrival of the steamer *Strathleven* from Australia, upwards of three years ago, it may be said that the trade in Colonial frozen meat was successfully inaugurated. Its development during the past three years, although gradual, has been sure, so much so that it may be safely predicted that the importations from the Australasian Colonies during the year 1884 will be more than twice the aggregate of supplies received thence during the three preceding years. Coincident with this increase of supplies, there has been an improvement in the condition in which they have reached the market. In the earlier stages of the industry, sufficient care and attention were not paid to the selection of sheep most suitable for slaughter; to the butchering and preparation of the carcases for refrigeration; to the safe transit and stowage on board the carrying vessel, and to the due maintenance of the requisite temperature during the passage to this country. Gradually these various links in the chain have been successfully welded, and recent statistics show that the percentage of arrivals of shipments not in good condition is quite nominal.

The foregoing remarks apply almost exclusively to shipments of frozen mutton and lamb. Those of beef have been received in such small quantity and at such irregular intervals as to preclude any reliable conclusions being derived as to the prospects of the Australasian dead beef trade. The reasons for this may briefly be stated to be: (*a*) irregularity in supply and consequent unsatisfactory outturn, and (*b*) the competition which those engaged in the casual ventures made had to face from supplies directed hither from European and American sources of production under more favourable transit conditions. While there is no doubt but that in time frozen beef will become a regular import, not only from Australia, but from New Zealand, in the immediate future the supplies of frozen meat from these colonies will consist almost entirely of mutton and lamb. While during the years 1880 and 1881 shipments of frozen mutton were received from Australia, it was not until the year 1882 that the Colony of New Zealand appeared as an exporter. The two shipping ports in Australia were, and still are, Sydney and Melbourne, and it is significant to observe that whereas the mutton from the former consists almost wholly of merino, that from the latter is cross-bred, and therefore better adapted to the requirements of British consumers. After the commencement of operations in the South Island of New Zealand, these were gradually extended to the Northern Island. In consequence of the various points of supply, a variety in the character, quality, and size of the carcases shipped has not unnaturally ensued. In consequence, too, of these divergencies, considerable fluctuation in values, even at any one time, has been manifested to such an extent, that in the Smithfield Meat Market, on the same day, a difference of 2*d.* per pound has been found to exist between the highest and lowest price obtained for New Zealand frozen mutton imported by the same vessel. As an outcome of this result, considerable discussion has been provoked, both in the English and Colonial press, as to the most profitable style of sheep to be reared in the Colonies for the production of carcase-mutton to be shipped in a frozen condition to the mother country. The general consensus of opinion points to the conclusion that a cross between a Hampshire Down ram and a merino or cross-bred ewe will best meet the required end *quâ carcase,* although the fleeces may not be so remunerative to the sheep-farmer as those shorn from animals bred under other conditions. In regarding the prospective development of this industry, the ability to produce the most suitable kind ofcarcase for the markets of the mother country is an all-important question. Viewed superficially, it may be argued that, because within the Australasian Colonies there are in round numbers about 77,000,000 (millions) of sheep, the annual increase, after making due allowance for deaths and other contingencies, and ample provision for the wants of a population, all told, of some 3,000,000, should be sufficient to warrant the export of a large number of carcases each year, a number far in excess of the probable receipts either during the present or succeeding year. A closer examination of the subject, however, reveals the fact that the area of country within which it will be profitable to produce the class of sheep required for refrigerating purposes is comparatively limited, and that if the export is to be tangibly or largely increased, it must be so by the shipment of carcases not exactly suited to the existing requirements of British markets. If it be asked why the merino type of sheep so largely produced in the Australasian Colonies, and the various grades of cross-bred reared in Victoria and New Zealand, should not be prepared in greater numbers for shipment hither, the answer can readily be given that neither are profitable carcases for the British consumer, the former because it is more affected by the process of refrigeration than the frame of the larger sheep, and the latter because the meat is too gross and yields an undue proportion of fat. It is possible that the existing drawback to the more extended consumption of merino mutton may in time be overcome, but this can only be done by its successful introduction amongst those classes of the population who now consume Welsh and other kindred varieties of small mutton.

In addition to the supplies of Australasian frozen mutton, shipments have also been received at irregular intervals from the River Plate. These have consisted in great part of carcases of merino type, in many instances much too small for the purpose. They have realised correspondingly lower values. With the large number of sheep produced in South America, it is not unlikely that more extensive and more regular supplies will gradually be received from the River Plate; and even although these are not quite adapted to our wants, the conditions of production there are such that, favoured by lower transit charges, River Plate mutton can be sold here profitably to the producer at 4½*d.* per lb. wholesale, while for Australasian shipments it is necessary that 6*d.* per lb. should be secured. The impetus which the development of this industry will give to prices of stock at the various centres of production being considerable, the tendency will be in the direction of enhanced cost; and for purposes of prospective calculation it may therefore be assumed that a selling price on average here of 6½*d.* per lb. will be requisite to attract increased supplies from the Australasian colonies. There is still much to be done in disseminating this meat throughout the provinces. While ample refrigerating chambers for the storage of shipments on arrival have been provided by the leading Dock Companies in London, no such appliances are to any extent to be found at provincial centres. Nor has the trade yet assumed sufficient proportions to induce the various Railway Companies to provide specially constructed refrigerated vans or wagons for the transit of the meat from the London Dock Companies to provincial markets. The transit is at present effected by means of ordinary meat vans attached, in the case of one or two railway systems, to passenger trains. While this secures rapidity in transit, it is attended with considerable expense.

The following statistics of the quantity, condition and price of Australian and New Zealand frozen mutton and beef are especially interesting just at the present time:—

AUSTRALIA.

	Consignments.		Number of Shipments.	Condition on Arrival.		
	Carcases. Mutton.	Qrs. Beef.		Good to Perfect.	Irregular to Fair.	Unsatisfactory.
1880 . .	400	a quantity	1	..	1	..
1881 . .	17,275	1,373	6	2	2	2
1882 . .	57,256	1,033	13	5	4	4
1883 . .	63,733	753	16	11	3	2
	138,664	3,159	36	18	10	8
1884 to 31st May	51,110	..	12	8	2	2
	189,774	3,159	48	26	12	10

NEW ZEALAND.

1882 . .	8,839	..	2	2	..	..
1883 . .	120,893	728	15	10	4	1
	129,732	728	17	12	4	1
1884 to 31st May	120,581	40	13	8	5	..
	250,313	768	30	20	9	1
Total to 31st Dec. 1883	268,396	3,887	53	30	14	9
Total to 31st May, 1884	440,087	3,927	78	46	21	11

NOTE.—*Marsala* (s.) at Port Chalmers (sailed October, 1882), jettisoned at Java 8,506 carcases mutton.

The following indicates the range of prices for sound Australian and New Zealand frozen mutton and beef respectively during the past year (1883), and to 31st of May last :—

	Mutton.		Beef.	
	Highest reported.	Lowest reported.	Highest reported.	Lowest reported.
Australian . . .	Sheep 7½*d.* per lb. Lambs 9*d.* ,,	4½*d.* per lb. 8½*d.* ,,	5½*d.* p. lb.	3½*d.* p. lb.
New Zealand . .	Sheep 8*d.* ,, Lambs 9*d.* ,,	4¾*d.* ,, 8*d.* ,,	6*d.* ,,	3½*d.* ,,

1ST JANUARY TO 31ST MAY, 1884.

Australian . .	Sheep 6¾*d.* per lb. Lambs 7½*d.* ,,	3½*d.* per lb. 6*d.* ,,	—	—
New Zealand .	Sheep 7*d.* ,, Lambs 9*d.* ,,	4*d.* ,, 6*d.* ,,	6½*d.* p. lb.	4*d.* p. lb.

On the 9th of June, 1884, quotations were as follow :—

	s.	*d.*		*s.*	*d.*	
Prime English Mutton . .	4	6	to	5	6	per stone of 8 lbs.
Do. Scotch do. . .	5	0	,,	6	2	,,
Do. Town-killed Foreign Mutton	4	2	,,	5	0	,,

	s.	d.		s.	d.	
Prime English and Town-killed Foreign Beef	4	8	to	5	0	per stone of 8 lbs.
Do. Scotch Beef . .	4	8	,,	5	4	,,
Do. New Zealand Mutton	3	8	,,	3	10	,,
Do. do. Lamb	5	0	,,	6	0	,,
Do. Melbourne Mutton .	3	2	,,	3	6	,,
Do. Sydney do. .	3	2	,,	3	4	,,
Do. River Plate do. .	——		,,	——		,,

But Australia, New Zealand and South America are not the only foreign countries which send us dead meat. Russia, Germany, Canada, and the United States, send us beef: Holland and the United States, mutton: and Germany, Holland and Belgium, pork in large quantities. This appears from the following Table in which the imports of dead meat into this country for the first four months of last year (1883) are compared with the imports for the corresponding period of the present year 1884:—

IMPORTS OF FRESH MEAT FOR FOUR MONTHS TO 30TH APRIL.

IMPORTED FROM	Beef.		Mutton.		Pork.	
	1883.	1884.	1883.	1884.	1883.	1884.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Russia, North . .	1,526	14,588	430	2	..	6
Sweden	136	53	..	..	4	15
Norway	4	18	..	..	..	..
Denmark	131	120	5	1	440	4,032
Germany	13,685	5,392	241	61	1,237	6,459
Holland	184	30	29,021	49,869	11,404	6,728
Belgium	..	..	2	162	8,896	10,585
Channel Islands . .	393	42	..	..	4	44
France	38	170	93	..	1,672	1,144
Portugal	95	250	..	..	..	..
Spain	..	17	..	..	..	2
Italy	..	..	..	..	10	1
Austria	..	..	7	..	5	11
Victoria	..	..	6,414	10,307	..	..
New South Wales .	587	..	5,752	13,681	..	..
New Zealand . . .	30	136	9,016	49,742	14	..
Canada	..	15	20	3	1	..
United States, Atlantic	269,824	278,262	22,383	13,912	..	100
United States, Pacific	..	..	..	..	2	..
British West Indies .	..	..	..	..	2	1
British Guiana . .	..	..	..	..	..	5
Uruguay	12	..	..	8,415	..	..
Argentine Republic .	..	..	..	3,369	..	..
	286,645	299,093	73,396	149,524	23,693	29,134

Our foreign supply of meat seems to be improving, because, contrary to what was anticipated by some public speakers during the recent discussions in Parliament and elsewhere, on the alteration in the laws with reference to the prevention of the importation of animals from countries affected with foot-and-mouth disease, the supply of dead meat is increasing, and appears to be taking the place of the importation of live animals. The Customs Returns for the past month (May) show this increase very clearly, for whereas the United States on the Atlantic Seaboard sent us 62,786 cwts. of beef, and 2458 cwts. of mutton in May 1883, they sent 99,620 cwts. of beef, and 83,815 cwts. of mutton in May 1884; and whereas New Zealand sent us 3662 cwts. of mutton in May 1883, that country sent us 15,242 cwts. of mutton in May 1884; and Victoria and New South Wales, which sent us no mutton in May 1883, sent us 3200 cwts. in May 1884.

And from the same returns we find that the following quantities of foreign dead meat were imported at the following ports in Great Britain in the two corresponding months of May 1883 and 1884.

	Beef.		Mutton.	
	1883.	1884.	1883.	1884.
	cwts.	cwts.	cwts.	cwts.
London	10,729	25,766	3,958	19,079
Liverpool	44,507	57,752	1,847	2,207
Glasgow	11,259	21,035	325	1,003
Total quantities imported at the above and other ports	66,544	104,639	7,212	26,344

This is only a repetition of what has happened elsewhere. The dead-meat trade of Paris, I am told, grows in a similar proportion; and so in America, where the dead-meat trade from the Western States to the cities in the Eastern States has quite cut out the trade in live animals from those

Western States. That this trade will go on increasing seems fairly certain, and as its tendency is to lower the price of meat to the consumer, we as consumers must rejoice at it, although it may perhaps render the English farmer's position even more difficult than it has been. But let him remember that there is no stock in the world like our Home stock, and that as the foreigner and colonist find a market for their meat in England, so it is to England that they will look to supply them with sires and dams to produce that meat.

To sum up, we may, I think, conclude that the best means of securing an adequate supply of meat to largely populated centres is by the system of dead meat, and that that system is by far preferable to the system of bringing in live animals and slaughtering them in the localities in which they are consumed. Amongst other reasons which appear to tell in favour of the dead-meat system are the following:—(*a*) It is cheaper; (*b*) As regards the population, it is more healthy; (*c*) It prevents the risk of spreading disease amongst the live stock; (*d*) It causes no suffering to the animals in transit. The sufferings which animals, and especially fat animals, endured in transit in former times were very severe; and although their sufferings are far less now because of the greater care that is bestowed upon them in consequence, partly perhaps of the requirements of recent legislation, and partly perhaps of the more considerate treatment with which all animals are treated nowadays, yet even now they suffer. Take for example the animals that had to be destroyed, or that were injured in the Transatlantic passage between North America (including Canada) and this country in the two years 1882 and 1883:—

In 1882, there were	3,130	Cattle and	Sheep	lost or	injured.
In 1883	„ 10,286	„	„	„	

The dead meat, again, cannot bring contagious or infectious diseases to healthy animals in the country into which it is imported, but, as the English farmer knows from past sad experience, diseased live animals as they travel from one part of the country to another, or as they come in from foreign countries to our own country, spread disease amongst healthy animals with which they may be brought into contact.

And the dead-meat system is more healthy as regards the population. When the meat is slaughtered in country districts, the inconveniences and nuisances caused by the disagreeable sights and smells of the slaughter-house, which must *ex necessitate rei* exist—however stringent the regulations respecting the slaughter-house may be—affect only a small number of people, and the illnesses which may arise to human beings when they are congregated in large numbers round the slaughter-houses are avoided.

But above all the dead-meat system of supply is cheaper than the supply by means of live animals. This is true of both home and foreign supplies, but especially of the latter. The cost of these is not restricted to freight alone, but to that cost must be added the charges and expenses incidental to bringing to port, shipping, landing, and preparation for and transport to market; and I am told, and can readily believe, that the rate of insurance is much higher for live animals than for dead meat. Then, again, in both cases, the home and the foreign, the live animals require food during their journey to market, and food means expense; but the dead meat does not. The live animals, too, lose in weight very severely during their journey. I cannot say how much exactly, but it is estimated that our home fat bullock loses 16 lbs., a calf 8 lbs., a sheep 2 or 3 lbs., and a pig 6 lbs. in their respective transits from the farm to the metropolitan slaughter-house; and it is a well-known fact that in the case of animals sent to the Smithfield Cattle Show, the decrease in the weight from the time when they leave the farm to their entrance into the Agricultural Hall is very considerable. Further, the dead-meat supply system does away with some at least of the middlemen to whom I referred in the earlier part of my paper; and so to this extent again cheapens the supply to the consumer.

But even in regard to dead meat, I cannot help thinking that we in London pay far too high a price for our meat. The farmer certainly does not get a high price for what he sells, but we consumers have to pay a high price for what we purchase. Let me put the following figures before you, which are not altogether imaginary. A farmer kills some 10 stone sheep, which he sends as dead meat to the Metropolitan Market. The meat salesman pays him (let us say) 5*s.* 6*d.* per stone for them—a good price :—

10 stone at 5*s.* 6*d.* a stone . . . =	55*s.*	per each sheep.
But we have to deduct salesman's commission, 1*s.* a sheep.		
Carriage by rail, 1*s.* a sheep.		
Which reduces the price to . . .	53*s.*	"
And the salesman also deducts (say) 2 lbs. off the weight, which, at 8*d.* per lb. (say) further reduces the actual sum received by the farmer to	51*s.* 8*d.*	"

This is the utmost the farmer receives.

Now what does the butcher receive ? The present prices for mutton are—

Chops	1*s.* or 1*s.* 1*d.* per lb.
Loins and Legs	11*d.* per lb.
Shoulder	10*d.* "
Neck	9*d.* "
Breast	7d. "

call it 10*d.* a lb. all round.

The sheep *ex hypothesi* weighs 10 stone or 80 lbs., and as we are dealing with dead meat and not the live animal, what is known as the fifth quarter does not come into our calculations. So we have—

80 lbs at 10*d.* a lb. =	66*s.* 8*d.*	Butcher's price.
But	51*s.* 8*d.*	Farmer's price.
Leaving to the Butcher	15*s.*	per sheep.

Out of this, not a very poor amount, the butcher has to pay his rent, rates, taxes, interest on capital, time, bad debts, &c. ; but allowing for all these, one would imagine that the amount leaves a good margin for profit. Of course the profit may, as I have before pointed out, have to be divided between the meat salesman, who pays the farmer, and the butcher who supplies the consumer, or the wholesale butcher may step in for his share before the retail butcher. But, however divided, or subdivided, or not divided at all the profit may be, the unfortunate consumer has to pay it.

Finally, I would ask, Is it either necessary or expedient that there should be this great difference between what the producer receives and the consumer pays? Is not this state of things artificial? Cannot some at least of the middlemen be dispensed with? Is it not possible to establish stores or depôts for meat, to which the farmers could send the meat, not the live animals, and from which the consumers might be supplied direct. These questions, I know, are not easily answered. Some such stores have been tried and have failed; and I am aware that it is said that if you do away with slaughtering in London altogether, you deprive a very large class of the consumers of the more inferior parts of the animals, which are the only parts that class can afford to purchase. But I would ask in reply, is it absolutely necessary that this should be so? Is it not possible, with improved methods for transit and storage, to send these parts to London, and so continue their supply to the class which requires them? Surely if they are so necessary, they can be brought in some better and more convenient form than as part of the live animal! I can but express the hope that the result of this conference will be to improve the meat supply of London, and that, while no class may be deprived of its meat supply, and while the farmer's receipts may be no less, the general mass of consumers may have their meat supplied to them at a cheaper rate than it is now. And if that should be the result, this conference, I feel, will not have been held in vain.

DISCUSSION.

The CHAIRMAN (Col. Kingscote) said he should be obliged to leave, but could not do so without saying a word or two on this important subject. He agreed cordially with what Mr. Druce had said, and he trusted this conference might tend very much to mutual confidence between the producer of meat and the consumer. The supply of meat was as important to one as to the other. During the controversy on the passing of the Cattle Diseases Bill he had felt himself that all he really wished for was protection from disease ; it was not a question of producer against consumer, it was a question which affected both, for keeping disease out of the country would make meat cheaper to the consumer. That was the spirit in which he took the matter up individually, and in which he believed most agriculturists did, and anything which would tend to cheapen the supply of meat would, in his opinion, also put money into the pockets of the consumers. If they could now act on the views which had been put forward so clearly to-day and devise ways and means of rearing calves, sheep and young animals of all sorts more carefully and cut down the various steps between the producer and consumer, so that there should not be so much made by the middleman, and at the same time disease could be kept out of the country, it would be an immense benefit for all concerned.

Mr. MITCHELL HENRY, M.P., then took the Chair.

Mr. T. B. WOODWARD said some excellent advice had been given them by various speakers, though it was not all unanimous. One gentleman came from Tasmania and recommended them all to go there, whilst the noble Lord recommended them to stop at home and put up paper sheds ; again Major Craigie and Mr. Duckham had dealt with the statistical side of the question ; and although he had the highest respect for statistics, he was afraid it was not really the side of the question which would help much in the present state of affairs. In December last, at the Farmers' Club, Mr. Geo. Street, a practical farmer, introduced a very interesting question on this subject, and the views he put forward were that the principal cause of the decline of the gross production of meat in this country was the decrease in the area of arable land. That opinion in the course of discussion was controverted by another practical farmer from the other side of England ; but from his own experience he was entirely disposed to support Mr. Street's view. Putting aside entirely the question of profit and loss, because they were not called upon to decide whether it paid to plough up land, the one important question before them was the cause, or one of the causes which had checked the development of our home production of meat. He believed any practical farmer, if he were asked whether he could on a certain area of land produce a greater weight of meat, whether as live stock or as butcher's meat, simply from grass, or if he had as much as he liked under the plough, he would reply under the plough system. If he were right in that statement, the Conference would next have a very serious question to decide, viz. what were the reasons why it did not pay to plough the land. A practical friend had just remarked to him that the principal reason was because the price they paid for store stock was too high. His answer was, why not breed stock themselves ? He had been connected with farming the greater part of his life, and for twenty or thirty years hardly bought an animal ; all the pigs, horses and cattle, and everything else being bred on the place. If ever there were a time when it was desirable to bring before the British agriculturist the idea of breeding and being independent of middlemen it was the present. There was one observation in Mr. Duckham's paper which very much strengthened his argument. He stated that in the year 1868 our sheep stock reached its maximum. Now setting aside again the question of profit and loss, and the question of disease, he would ask Mr. Duckham, whether about that year, 1868, there was not the largest area of land under the plough this country had ever seen. If so he thought that evidence was very strong to support his argument. His next suggestion in regard to rearing stock was as the result of his observation that not one farm in twenty in England was properly and sufficiently supplied with the necessary accommodation, either for the feeding or rearing of cattle. His own experience had been that in precisely the same style of husbandry and the same style of land, if you turned your old barns into cattle sheds, put up outlying fold yards with proper sheds, you could with more economy in the style of agriculture and in using straw and provender produce 20 per cent. more live stock. He had heard it stated in public, though he did not vouch for it, that in this country there were 15 millions of acres not cultivated at all. What was the remedy for this grave state of things? To make agriculture a free industry, to let the British farmer be in a position to make the most of his land, then, depend upon it, his good sense, his pluck, his enterprise and his skill would meet the occasion.

Mr. DUCKHAM, in reply to the question asked by the last speaker, said that in 1868 there were 30,711,396 sheep and 17,737,627 acres of arable land; in 1872 there were 27,921,507 sheep, and 18,351,283 acres of arable land.

Dr. C. R. DRYSDALE said it had given him great pleasure indeed to come to this Congress, because he, being himself a medical man, having nothing to do with agriculture, considered that the question now being discussed was most important from the hygienic point of view. Medical men were continually discussing the causes of disease at different times, but it was forgotten that the most important point of all was that people should have enough to eat. This Conference, it appeared to him, was endeavouring to solve the most vital question the human race had ever endeavoured to solve, how to get sufficient meat supplies. It was quite possible to get supplies of starchy food, such as grain, from all parts of the world; you could buy it at 40*s.* per quarter in London, but the great difficulty was to get the most essential part of human diet, animal food. Animal food was the most important element to the greatness of a nation. No nation living on vegetable food ever showed great energy, and those who adopted that diet were always conquered by others. When one looked at the quantity of meat consumed here, and compared it with that consumed in Italy, the importance of keeping up the supplies of animal food would be at once seen. It was assumed that at present Englishmen consumed 100 lbs. per head per annum, but in Italy they only consumed 18 lbs. per head.* The supply of home grown English meat was supposed to be one million tons, and that imported about 470,000 tons; so that we were fast coming to the point when we should be obliged to import as much animal food as we grew at home, which was to him most appalling; and it seemed to him we were fast approaching the time when we should become like the Chinese and Hindoos and have to live almost entirely on vegetable food. Every day 1,000 people were added to our numbers, but he believed the amount of animal food capable of being produced had almost reached its limit. At the present moment, there were only 28 millions of sheep and 10 millions of cattle and so many millions of pigs; in the year 1868, which Mr. Duckham had spoken of, there were far more sheep, but there were only 8 million of cattle, so that if added together he thought there would be about the same total weight of animal food in 1868 as at the present time. It was the same story throughout Europe. All over the Continent there was what might be termed a meat famine. In some countries they could only consume 18 lbs. per head per annum, and in France it was 70 lbs. The vital importance of this question lay in this that our length of life greatly depended on what we lived upon. The richer classes, who got far more to eat, and far more meat, had an average life of 55 years; but if you took the poorer classes in Bethnal Green, the average age at death was not above 30, so that there was a difference of about 26 years between the life of a well-fed and an ill-fed person. One great reason of that was that the working classes had to work with far too little nitrogenous food ; and he wished to point out the extreme danger to a nation of what had been lately styled vegetarianism. There were people who said that our food difficulties would vanish if we simply gave up animal food, and took to eating cereals, but he entirely objected to this doctrine, which he considered most pernicious. The reason of this was that the nitrogenous parts of food were very much more easily digested when taken in the shape of animal food than in the shape of vegetables. The nitrogen contained in 1 lb. of meat was almost entirely taken into the blood, only 2½ per cent. passing out of the body undigested ; but if the same quantity were taken in peas or beans, or even in coarse bread, as much as 40 per cent. of the nitrogen would pass out of the system without ever entering the blood at all. Consequently, the great point in diet was to take the 4 oz. of dry albumen, which were required every day, not in the shape of vegetables, but in the shape of meat ; and it was the greatest mistake for those who had to do energetic work to think that they could live as well without taking animal food. It was a vast mistake in an individual, but in a nation it was a still greater fault, because if a nation did that it would inevitably fall off in its power of endurance and produce fewer great men. If these Conferences were only continued for some time, so as to impress on the public the vast importance of this subject of food, it would do more to increase the longevity of mankind than any other hygienic measures.

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* 'Armeé und Volks- Ernührung,' by Dr. Meinert. (Berlin, 1880.) 2 vols., p. 151.

Mr. THOMAS POOLE said in a great deal of what he should have said he had already been anticipated by Mr. Woodward, especially with regard to buildings on farms. He thought landlords would have to do a great deal more before the tenantry could much improve in stock raising. With regard to Mr. Druce's travelling bullock, they must recollect that Londoners only took the best beasts out of the country, and they would always have to pay a little extra in the carriage of the best meat which was produced and picked out for their use. A good deal had been said about arable land versus pasture-land, and that all they had to do was in the direction of seeding more land down for permanent pasture, but that will not help farming unless the greater portion of it is first well drained. The Agricultural Holdings Act had done something, but that has not gone to the bottom of it yet. The Act was of great benefit to the best farmers on good arable land, corn and cake users ; but there was nothing done by that Act for farmers on cold lands all over England, and the advice which must still be given to farmers of that class was, farm it as low as you can, for you would get nothing at all for improving it. There was no compensation for farming arable land well at present, and until something was done in that direction they would not get much more meat produce from that class of land. Besides all this, there was a great deal of land unoccupied which ought to be made use of in growing food, &c.

The Rev. THOMAS FLAVELL (Christchurch, New Zealand) said he was neither a farmer, grazier, nor landlord, and though he was a shepherd, his sheep lived 12,000 miles away. Some hard things had been said about frozen mutton that morning, and he had heard some depreciatory remarks made on the appearance of the Australian mutton in the Exhibition. He had heard one gentleman say, "We can show better than that at Christmas." Undoubtedly that was so, but the mutton was not prize Christmas meat ; it was simply the ordinary production. He did not want to depreciate English mutton in the slightest degree ; of course it was superior to mutton all over the world, and it would be a disgrace to England if it were not so, considering the many years during which attention has been devoted to the science of agriculture and to the breeding of sheep in this country. Still, there were several reasons why the mutton grown in New Zealand should be nearly, or quite equal to, that of England. In the first place the farmers there imported the very best stud sheep, and paid large prices for prize rams. Secondly, the food was equally good, if not better ; for they had

English grasses which grew there luxuriantly, and sheep and cattle fed on them. Thirdly, they had perhaps the most beautiful climate in the world ; and besides that there was no foot-and-mouth disease, no fluke, and very little scab ; so that, on the whole, he did not see why New Zealand mutton should not be as good as English. He should also say that the utmost care was taken in selecting and choosing the meat which was prepared for exportation, and special means were taken to convey it from the freezing place to the ship's side. There were, on the other hand, several obstacles to its general use ; one was that the storage price was too great, and he had been very glad to hear that morning that that was being reduced. He should send out the information by the next mail to New Zealand, where he was sure it would be received with much gratification. In fact the storage absorbed the very profit which the sheep farmers in New Zealand wanted. Moreover, the mode of distribution here in England required more attention. In New Zealand special trucks were used to convey it, and the same should be done here. Again, the proper mode of thawing did not seem to be understood ; sufficient time was not given to it, and it was often not properly cooked. If these things were attended to, and a fair trial given, he was quite sure it would grow rapidly in public favour.

Mr. MALLOWS said he thought the freezing took all the taste and quality out of the meat.

Mr. HUGH CLEMENTS said this question of meat supply was of very great importance, and affected the consumers even more than the farmers. He fully concurred in the conclusions which Mr. Druce had arrived at, that it was far more profitable to import dead meat than live cattle, which was undesirable for many reasons. When the animals arrived they were often weak and upset by the journey, and therefore were in an unhealthy condition. The amount of dead meat imported annually was only 450,000 tons, whilst the live meat was 1,200,000 tons. He believed the average amount of meat produced in England remained about the same from 1868 to the present time, but at some periods there were more cattle, at others more sheep, and at others more pigs, but the average still remained the same, about 1,200,000 tons. When cattle and sheep went down, pigs went up, because they were more easily reared. He did not think the produce of meat could be much increased, at any rate until there was greater security given to the tenant farmer.

Mr. JACOB WILSON said if that meeting had proved one thing more than another, it was that figures and statistics, when taken alone, were highly misleading. Some recent speakers might be very eloquent and able in figures, but he feared they lacked that knowledge of practical agriculture which this subject required. It seemed somewhat extraordinary to be told that as soon as sheep began to die pigs begin to live. A few years ago when bacon was imported very largely into this country, it was due to the tremendous crop of American corn which caused more bacon to be produced. One thing had been thoroughly shown by the discussion, and that was that those who had for some years past been advocating further restrictions in the importation of disease into this country, had been fully justified in saying that the interest of the consumer and the producer were identical. The importation of foreign meat had been brought much to the front, and he had been somewhat struck by the tone in which the subject had been treated. They were told in the morning that English people behaved exceedingly ill to Australians by not giving them proper opportunities for placing that meat before the public, but it appeared to him that if there was one person more than another who reaped a benefit from that importation it was the exporters in the colonies, and he should have expected that they themselves would have endeavoured to afford such facilities in this country as would have distributed the food most profitably, and to the greatest benefit to the public. He had paid many visits to the docks, and seen the meat in all its stages until it reached the stalls in the market, where it was sold at about 6*d.* a lb. But that meat did not find its way to the poor working man. Why did not the Australian exporters furnish small depôts all over London, so that the poor man might have the benefit of that meat at a cheap rate? He protested against gentlemen coming and saying that the colonists only wanted fair play—the English farmers only wanted fair play too; but thank God they had it now, and he trusted that they would have no further importation of foreign diseases. They would welcome foreign cattle dead or alive to feed the people, but they did not want any foreign diseases. He, along with other farmers, viewed with great satisfaction the improved condition of their flocks and herds. They had by the most stringent regulations reduced the number of diseased animals almost to a minimum—and matters had now arrived at a stage when he thought it the duty of the Government to take advantage of the powers they possessed, and by slaughtering those few animals to exterminate the disease altogether. Why the Government did not put those powers into operation he could not conceive, and he thought the country ought to insist on its being done. It was now so small a question that rather than it should not be done, he would appeal to his fellow-countrymen whether a public subscription should not be got up to do it. One thousand pounds would rid this country of all the foot-and-mouth disease at present existing. When they were told by amateurs and others that they would have a constant recurrence of these diseases from natural causes, he would refer to the important fact that after restrictions had been imposed during the time of cattle plague, the foot-and-mouth disease disappeared, and what could be done once could be done again. In that opinion he was supported by that very eminent authority, Mr. Dunn, the chief constable of Cumberland and Westmoreland, who issued useful statistics weekly, and who was also of opinion that £1000 would be ample to rid the country of the disease. He therefore threw out this suggestion, and hoped it would be taken up, for he knew hundreds of men would gladly give £5 or £10 towards such an object. He congratulated Major Craigie and those who had been instrumental in getting up this Conference, and trusted it would be the means of keeping this important subject before the public and prove a great benefit to the country at large.

Dr. G. E. NICHOLAS, M.O.H. (Wandsworth), desired to say a word or two with regard to that portion of animal food which was introduced into this country in tins. Numerous complaints had of late years reached him, and many of which had been within his own knowledge, of serious consequences resulting from the consumption of tinned meats. These ill effects were attributed by some to the formation of salts of tin through the use of hydrochloric acid, which was employed in soldering; but there could be very little doubt that they were really the result of decomposition; that the air which was supposed to be excluded by hermetically sealing was not really so, but that it still remained although in an attenuated form, and in process of time decomposition took place. Now the public had no means of ascertaining the age of the contents of these tins, and he thought it was worth considering whether some means might not be devised by which the purchaser might be secured against these inroads upon his health, possibly by requiring the date when the tins were prepared to be marked upon them.

Mr. W. LIPSCOMB proposed a vote of thanks to the three chairmen who had presided during the course of the day. Mr. Mitchell Henry had mentioned one of the most important of all the items which to his mind lay at the bottom of the future prosperity of British farmers, in pointing out the desirability that Irish store stock should be abundant and cheap. In that lay the kernel of their hopes for making the margin between the lean and fat animal large enough to produce the profit which for many years they had lost. If there were any hopes for them at all it lay in the direction of breeding stock being largely increased. Over and over again in the West Riding he he had been insisting on a point which was often overlooked, namely, that the foot-and-mouth disease produced barrenness; they were told by some people that this disease was not of much importance, because the meat was none the worse, but if the females upon whom they were dependent for future increase were no longer capable of breeding, how could they expect the numbers to be kept up, still less increased? *ex nihilo nihil fit.* For store cattle they looked mainly to Ireland; and there, with all respect to Mr. Mitchell Henry, there was a very much larger margin between the capabilities of breeding cattle, and the present state of things, than existed either in Scotland or England. There was greater mismanagement there. He had often been there, and was delighted to see the improvements effected by Mr. Mitchell Henry; but the question which as a practical man he had been watching throughout all the discussions with regard to Ireland, which had mainly turned on political matters and not on the material prosperity of the country, was, where was the capital to come from for the improvement of those lands and buildings? All who had been there knew how little improvement there had lately been in either, because there had been so little capital devoted to it, and that was the main thing required to develop and increase the prosperity of the country.

Mr. F. S. POWELL, in seconding the motion, said his pleasure in doing so was greatly increased by the circumstance that Mr. Mitchell Henry had occupied the chair during a portion of the proceedings. He had witnessed the improvements which that gentleman had made, and if there had been more Irish landowners who had had the same financial means, knowledge, and ability, that country would have been in a much more happy and prosperous condition than it was; and as had been already remarked, Ireland was one of the most important sources of food supply for the great population of this country. As Ireland prospered, so would the population of this country prosper; and this was a remarkable illustration of the manner in which the interests of England and Ireland were in reality entwined together, when one prospered, the other fared well, and when one suffered, both were afflicted.

The CHAIRMAN having briefly acknowledged the vote of thanks, the proceedings terminated.

THE ADULTERATION OF FOOD.

CONFERENCES BY THE INSTITUTE OF CHEMISTRY
ON MONDAY and TUESDAY, JULY 14th and 15th.

FOOD ADULTERATION AND ANALYSIS.

INSTITUTE OF CHEMISTRY.

CONFERENCE ON MONDAY, JULY 14, 1884.

Professor W. ODLING, M.A., F.R.S., President of the Institute, in the chair.

THE CHAIRMAN said the Executive Council of the Exhibition had invited the Institute of Chemistry to hold a conference on the very important subject of the adulteration of food, and the modes of analysing it, and he hoped that having before them a subject of this kind, to which so much attention had been paid by so many eminently qualified, a discussion of considerable interest must arise, and that some good in the way of increase of knowledge and increase of agreement as to the points desirable to attain in future must be arrived at.

FOOD ADULTERATION AND ANALYSIS.

By Dr. JAMES BELL, F.R.S.

ADULTERATION, in its widest sense, may be described as the act of debasing articles for pecuniary profit by intentionally adding thereto an inferior substance, or by taking therefrom some valuable constituent; and it may also be said to include the falsification of inferior articles by imparting to them the known appearance of commodities of superior quality.

The evils of adulteration may be viewed either from a sanitary, moral, or pecuniary standpoint, and it is no doubt chiefly in its relation to the health of the people that the subject of Food Adulteration and Analysis has been chosen for a Conference in connection with this Exhibition.

Of the sanitary evils of the adulteration of food there cannot be the faintest doubt, and even on this ground alone the practice merits the severest condemnation. This is the case when the substance added merely reduces the nutritive value or characteristic property of the food, but the offence becomes highly criminal when the adulterant also possesses properties injurious to health.

The moral aspect of this question should never be lost sight of. No man can continuously practise deception without losing self-respect, and, also, when detected and exposed, the respect of his fellow-citizens. Moreover, in such circumstances, a feeling of uncertainty on the part of the buyer is created, and his first idea on the receipt of a commodity of somewhat lower quality than usual is that it must be adulterated. The honest vendor thus shares with the dishonest one the general penalty of suspicion, and the transactions of nearly all dealers in articles of food are viewed with distrust.

But it is from the pecuniary standpoint that the question is most often viewed by the general public, for the primary cause of adulteration is a desire for unjust gain to be obtained, either at the expense of consumers, or by taking unfair advantage of competitors in trade.

If the adulterated .article is sold at the ordinary price of the genuine commodity, the consumer is robbed of the amount represented by the diminished value; whereas, if it be sold as genuine, though at a proportionate reduction in price, the unfair competition tends either to seriously injure their honestly-disposed rivals in trade, or, what is but too often the case, to drive them into a similar course. Attempts have sometimes been made to estimate roughly the amount of pecuniary loss suffered by consumers owing to the adulteration of different articles of food, but, for my part, I have never been able to see that any reliable data were obtainable upon which to form even the rudest approximate estimate.

The practice of adulteration is by no means of modern date, but has existed, more or less, from time immemorial. There is evidence that it was practised by the Greeks and Romans, and it has probably been co-existent with the development of commerce.

The earliest enactments in this country in reference to food appear to have had a much wider scope than those of recent years, for they embraced the quality as well as the genuineness of the article, and dealers in foods or drinks which, from whatever cause, were considered as unwholesome, were fined once or oftener, and then, if found incorrigible, were condemned to bodily punishment. The first enactment on the Statute Book is the 56 Henry III., cap. 6, passed in 1266. Under this and subsequent statutes or "Assizes," the baker was to be punished if he sold bread light in weight, or made from unsound wheat, or at too high a price in relation to that of wheat; the brewer if he was not sufficiently liberal with his malt in proportion to the price of barley; the beer-retailer if he sold ale drugged or short in measure; the vintner, if his wine was drugged, corrupted or unwholesome; and the butcher, if he sold diseased meat.

When we consider the difficulty which at the present time we experience even with increased knowledge and appliances in suppressing adulteration, it is not to be wondered at that the machinery of those days failed to put an end to the evils complained of.

With the exception of one or two Acts relating to the adulteration of bread, all the legislation upon articles of food from the time of George I. to the year 1860, had reference to the protection of the revenue, and therefore only indirectly guarded the health or pocket of the consumer. The Acts within this period related principally to tea, coffee, beer and porter; and, if we are to place any reliance upon the words of an Act of Parliament, the adulteration of tea a hundred years ago must have attained very alarming proportions. The Act, 17 Geo. III., cap. 11, states that great quantities of sloe leaves, and leaves of ash, elder, and other trees and shrubs were then being manufactured and sold in imitation of tea, to the injury and destruction of great quantities of timber, woods, and underwoods.

In the year 1851 there was considerable agitation amongst planters and others interested in the production and sale of coffee, in consequence of the falling off in the consumption of that article caused by its wholesale admixture, as permitted by Treasury Minute, with chicory. Petitions were presented to both Houses of Parliament on the subject, and it was perhaps the general attention directed at that time to this matter which induced the proprietors of the *Lancet* to perform a public service of the highest value. In 1851 and several following years, at their own expense, they instituted an extensive inquiry into the character of the food, drink, and drugs sold in London, and engaged chemical and microscopical analysts for that purpose. The results showed that adulteration prevailed to an alarming extent, and that in many cases the adulterants were of a nature highly injurious to health. The Editor of the *Lancet* showed his confidence in the analysts employed by publishing in that journal the results of the analyses, whether favourable or otherwise, together with the name and address of the vendor. The increased public attention thus caused, resulted in an inquiry by a Select Committee of the House of Commons, in 1855, which reported that adulteration of food, drink, and drugs was very prevalent, and that some of the adulterants used were of a poisonous nature. Following upon that report, and as a consequence thereof, the first general Act in this country was passed in the year 1860. This Act may have exercised to some extent a deterrent effect, but beyond this the practical outcome of it was but small, for the appointment of analysts was permissive, and the obtaining of samples for analysis was left to private purchasers. Another Act was passed in 1872, extending the right of appointing analysts to boroughs having separate police establishments, but still left such appointments optional. A most important provision, however, was made for the purchase of samples by local officials, and the right was given to private purchasers to have samples analysed on payment of a small fee.

The adoption of the Acts of 1860 and 1872 was by no means general, but was principally confined to London and the large towns; and even where adopted, the action taken was often of a very restricted character. The prosecutions which ensued, however, were sufficiently numerous to cause a general outcry from tradesmen about alleged miscarriages of justice; and in answer to petitions from most of the large towns, the Government decided to appoint another Select Committee of the House of Commons to enquire into the working of these Acts. This Committee reported that while the Acts had done much good, they had likewise done considerable injury, as many heavy and undeserved penalties had been inflicted upon respectable tradesmen, and that such injury had arisen partly from the want of a clear understanding as to what constitutes adulteration, and partly from the conflicting opinions and inexperience of the analysts employed, some of whom appeared to have evinced a great want of discretion. It was recommended that the Acts of 1860 and 1872 should be repealed, and that a new, extended, and compulsory Act should be substituted for them. The chief amendments suggested were the inclusion of the fraudulent abstraction of an important property of any commodity, such as the removal of cream from milk, as a punishable offence; the examination of tea on importation; better regulations for obtaining samples, and for securing the appointment of qualified food analysts. To meet an important want provision was also made for obtaining an independent analysis in case of dispute.

A great improvement had evidently taken place since the previous Parliamentary Committee had sat in 1855, especially in regard to the deleterious nature of adulterants used, for this Committee concluded their Report by expressing their belief that it will afford some consolation to the public that in the matter of adulteration, they are *cheated* rather than *poisoned;* and that if deleterious substances are occasionally used for the purposes of adulteration, they are used in such minute quantities as to be comparatively harmless. Further, as a matter of policy, they pointed out that they did not consider that Parliament desired needlessly to hamper or fetter trade, still less to interfere between the buyer and seller with the view of regulating prices, or attempting to assist the consumer in ascertaining the real money value of any marketable commodity.

Upon the lines indicated in this Report was framed the Bill which passed into law as the Sale of Food and Drugs Act, 1875, and which is the Act now in force, though amended in some respects by the Sale of Food and Drugs Amendment Act, 1879. I shall now pass on to consider 1st, the object of these Acts; 2nd, the machinery provided for attaining that object; 3rd, how far the Acts have succeeded; and 4th, analysis in relation to adulteration.

The title of the Act of 1875 states that it is "to make better provision for the Sale of Food and Drugs in a pure state." Although expressly intended to suppress adulteration in food, drink, and drugs, the word "adulterant" or "adulteration" does not occur in any of the clauses, for the reason, I believe, that no definition of these terms could be framed to meet all practical requirements. The sale of mixtures is freely allowed, provided that the nature of the commodity sold is brought to the notice of the purchaser before the sale is completed, so that if necessary it may be declined, and that no ingredient has been added so as to render the article injurious to health.

The fundamental idea of the Act is found in Section 6, which enacts that "no person shall sell to the prejudice of the purchaser any article of food, or any drug, which is not of the nature, substance, and quality, of the article demanded by such purchaser." Here is a clause capable of a very wide definition, but I think the spirit of the section is fairly expressed by Mr. Justice Mellor in delivering judgment in the Appeal Case of Hoyle *v.* Hitchman, when he says, "The offence intended to be prevented by the Act was the fraudulent sale of articles adulterated by the admixture of foreign substances which would necessarily be to the prejudice of the purchaser, and those words were inserted only to require that such adulteration should be shown to have been made;" and further, "if the purchaser asks for a certain article, and gets an article, which by reason of some admixture of a foreign article, is not of the nature or quality of the article he asks for, he is necessarily prejudiced."

It would thus appear that for a purchaser to be prejudiced within the meaning of this clause, it is necessary that the article sold should contain some admixture of a foreign substance not specified at the time of sale; and therefore that the purchaser is not legally prejudiced when the article sold is of low quality but genuine. This view will be found confirmed in the twelfth Report of the Local Government Board, in which it is stated that "the Sale of Food and Drugs Acts are not designed to prevent the sale of poor articles, but that of adulterated articles." It has been urged that samples should be judged by those of average quality, which the purchaser might reasonably expect to get; but this was evidently not the view of our legislators, for Parliament deliberately abstained from fixing limits of quality for natural products, whether in a raw or prepared state.

I come now to the means provided for suppressing the adulteration of food. The Local Authorities of each city, metropolitan district, county or borough, throughout the United Kingdom, have now the power to appoint inspectors and duly qualified analysts for the purchase and analysis of samples, and should they not appoint an analyst voluntarily, they are required by the Act to do so when called upon by the Local Government Board in England, or a corresponding authority in Scotland and Ireland. When any sample purchased, according to the provisions of the Act, is found adulterated, the vendor can be summoned before a magistrate, and on conviction fined in a sum not exceeding £20 where the adulteration is simply to the prejudice of the purchaser. When, however, the adulterant renders the article injurious to health, the maximum penalty is £50 for a first offence, and six months' imprisonment on subsequent convictions.

On payment of a fee not exceeding 10*s*. 6*d*. a private purchaser may have any article analysed by the public analyst, and, if found adulterated, the vendor, if the provisions of the Act have been complied with, may be prosecuted and fined as if the purchase had been made by the inspector. The requisite official machinery has not been provided in all places, and the Local Government Board do not appear to have power to enforce the appointment of inspectors, nor the purchase of a sufficient number of samples to ensure the efficient working of the Act.

I find, on inquiry, that though analysts have been appointed for most places in England and Wales, there were no fewer than sixty-three boroughs and three counties in which no samples whatever were analysed during the year 1883, and in many other places the number analysed was very small.

In Scotland, out of thirty-two counties only seven have yet appointed analysts, and of these two have had no samples examined for six years, while a third has only had one sample, and a fourth only three samples analysed during the last three years. Of 167 royal and police boroughs, thirty have appointed analysts, thus showing only thirty-seven appointments for the whole of Scotland out of a possible total of 199, or about one in five.

In striking contrast to Scotland is Ireland, where an analyst has been appointed for every place except one borough and one county.

In considering some of the general results which have been obtained by the working of these Acts, it would manifestly be unfair to institute a comparison between the years prior and subsequent to the Act of 1879, which laid down minimum strengths for spirits, so I confine my statistics to the last three years for which returns have been issued by the Local Government Board. I regret that I have been unable to obtain complete returns for Scotland and Ireland, so the following data for the years 1880, 1881 and 1882, showing the total number of samples analysed in each year, with the percentage of samples reported as adulterated, refer to England and Wales only.

Year.	Total Number of Samples Analysed.	Percentage Reported Adulterated.
1880	17,673	15·7
1881	17,823	14·6
1882	19,439	15·0

The percentage of samples found adulterated varies, as might be expected, somewhat from year to year in the various commodities ; but on the whole, and so far as these returns show, it is practically stationary.

These are the only data available, so far as I know ; and valuable as they are for comparison from year to year, there are several reasons why they afford only a roughly approximate idea of the extent to which adulteration is practised in this country. On the one hand, the samples are nearly all purchased by inspectors, many of whom are personally known to the tradesmen,—the object for which the purchases are made being perfectly well understood ;—whilst some districts throughout the country are inadequately, if at all, represented. On the other hand, a large number of samples are returned as adulterated where the amount is so small that no proceedings are instituted ; and to these may be added samples of which adequate notice of admixture had been given at the time of purchase, and also samples of impure well-waters, which are sometimes classed as adulterated. I may also mention that of 528 samples purchased by private individuals in one year, the percentage found adulterated was 25, as compared with only 14·5 per cent. in the samples purchased by the official inspectors during the same year ; but this may partly be accounted for by the fact that a private purchaser has generally good grounds for suspecting adulteration before going to the trouble and expense of having the article analysed. The small number of samples submitted for analysis by private purchasers has been more than once commented upon by the Local Government Board, and shows, I think, that the expense of the analysis, together with the trouble involved in the event of a prosecution, are more than private individuals are willing to bear. Perhaps this is not surprising when it is considered how small an amount individually they have at stake, and how readily they can, when dissatisfied, change their tradesmen.

The working classes, especially, who form the bulk of the population, and are the greatest sufferers from adulteration, can hardly be expected to take action on their own account if only by reason of the expense ; but there is often the further impediment of the analyst being many miles away, and doubtless in such cases his name and address are not always generally known.

It is much to be regretted that an evident unwillingness has been found on the part of some local authorities to bring these Adulteration Acts into operation. The Acts are practically a dead letter in some districts even where nominally complied with, owing to the small number of samples purchased, or the conditions under which the purchases are made. In the twelfth Report of the Local Government Board it is stated, that in some cases "scarcely any attempt is made to conceal the official character of the buyers, or the purpose for which they are buying ;" and the Board add, what must be perfectly obvious, "that unless the samples obtained by the inspector are of the quality ordinarily sold to the public, the object of the purchase is frustrated."

In some districts the local authorities have been much discouraged by the small fines imposed by the magistrates, even when the offence has been committed more than once. There can be little inducement for them to carry out these Acts energetically when they find that after going to all the expense and trouble of the purchase and analysis of samples, and taking the necessary legal proceedings against a fraudulent tradesman, the heinousness of his offence is assessed by the magistrates at such a trifling sum as cannot in any view be held to be a deterrent penalty, but one readily covered by the illegitimate profits of a few days.

The tendency in recent years has been to place increased discretionary power in the hands of magistrates. For many years prior to 1879, their discretion in matters of fines in Revenue cases was limited to reducing penalties to not less than one-fourth of the amount named in the Act. By the Summary Jurisdiction Act of 1879, however, they were given full discretionary power in first offences, but the former restriction remains in force for second and subsequent offences. Some such regulation may be found desirable under the Sale of Food and Drugs Acts, especially in cases where the vendor is the actual adulterator.

In discussing the relation of analysis to adulteration, it is not my intention to review the various methods of analysis, but merely to refer briefly to some of the analytical difficulties experienced in dealing with the subject. When the adulterant differs chemically or microscopically from the article to which it is added, as when alum is added to flour or bread, or wheat flour to mustard, the detection of the adulterant is only dependent upon the skill and experience of the analyst. But when the adulterant is similar in character to, or identical with, one of the constituents of the article to which it is added, we are met at the outset with a formidable obstacle in the fact that natural products of all kinds vary greatly both in composition and quality, and the problem presented for solution is then whether lowness of quality is due to natural poverty or to adulteration.

There are butters, for instance, so rich in quality that they would admit of a large addition of foreign fat, and still yield analytical results within the limits of genuine, but poor, butter. Again, it is well known that the milk yielded by some cows is of so low a quality as not to be equal to that from other cows with a large proportion of added water. Further, there are some teas which, regarded from whatever test of quality we may apply, are so rich that they will bear a considerable admixture of partially exhausted tea-leaves and still yield results equal to those from other poorer, but yet genuine, teas. This is the difficulty which, more than all others of a scientific nature, stands, and I fear will continue to stand, in the way of the entire suppression of adulteration.

Unfortunately, the history of food analysis shows that this difficulty in dealing with natural products has been increased to some extent by the adoption of different processes of analysis, which, in the hands of various chemists, have yielded results differing so materially as to lead to contrary opinions upon the same sample. To my mind, it is therefore most important that whatever analytical process is used, it should yield absolute, and not comparative, results.

There are, however, occasions on which differences of opinion between analysts may be expected to arise, as, for instance, when the microscope has to be depended upon for the detection and estimation of the adulterant. Any want of concord between analysts in respect to their estimate of the proportion of adulteration in such cases as the presence of barley-meal in oatmeal, or rice flour in ground ginger, should not be made too much of, as the certain proof of admixture is the main thing to be desired, and it can make but little difference whether the percentage of the adulterant be returned, say, as 15 or 20 per cent.

It is frequently urged that certain "limits," founded upon the analyses of samples of average quality, should be laid down and legalised for natural products, below which such products should be deemed to be not "of the nature, substance, or quality of the article demanded," but the adoption of such "limits" might lead to grave difficulties. It is the opinion of practical men that it would be unwise to adopt any legislative measure with respect to limits of quality which would tend to discourage production, and diminish the supply of any article of food. It would manifestly be an economic blunder, if, for instance, in order to raise the quality of milk by one half of 1 per cent. on the non-fatty solids, the actual production were to be diminished by 10 per cent. in quantity.

Following these views, it may be of interest to particularise some of the principal articles of food, and the results of the analyses of samples under the Adulteration Acts of 1875 and 1879. I have taken the data from the Local Government Board's Reports, founded upon Returns made by the Public Analysts, and of which an able Summary for the five years, 1878 to 1882, will be found in a valuable 'Handbook on the Law of Adulteration,' by Thomas Herbert, published by Knight and Co., of Fleet Street.

Milk.—Beginning with milk, we find that it differs from most other natural food products in that it is sold to the public, and, as a rule, consumed, in its natural state; also in that it is difficult, from a general inspection of its appearance, or from its taste or smell, to form a fair idea of its quality; and further, in that within the same town or district it is mostly sold at a uniform price, except in special cases for nursery purposes.

The judging of the quality of milk may therefore be considered to be largely dependent on analysis, and having regard to the facility with which it can be adulterated, the public require a greater amount of assistance in order to secure a supply of genuine milk, than they do in the case of almost any other article of food. I have little doubt that in course of time, with the increasing means of education, the public will become more skilful in judging of the quality of milk and other commodities, and will be able frequently to detect those instances of gross adulteration which may now pass unobserved.

The range of quality in the milks obtained from healthy and well-fed cows is very considerable. Taking the non-fatty solids of the milk as a criterion of value, I have found in common with others that the percentage varies—with a few exceptions on either extreme—from 8·2 to 10·8 per cent. It is evident that a milk of the higher value might be subjected to a good deal of watering—about 25 per cent.—and still yield the results obtained from the poorer, but still genuine, milk.

This opening to sophistication which the differences in the quality of milk permit, is not less, but even exceeded in the case of butter, owing to the greater range in its quality, a point I shall shortly have to notice.

For a long time it was contended that cows which gave milk containing less than 9 per cent. of non-fatty solids were either diseased or starved, but this notion may now be said to be dispelled, for the more the matter has been investigated the more has such a position been found untenable.

Milk yields very variable proportions of fat. The percentage is sometimes as low as 2·2, and occasionally rises to as high as 6. This great range of difference affords facilities in some instances for the abstraction of part of the cream, and unfortunately renders the analysis in such cases of but little value in protecting the public against this species of fraud—a circumstance much to be regretted when the high value attached to the fat of milk is considered.

As to the necessary groundwork of milk analysis, chemists are universally agreed. The data sought for are the percentages of fat, non-fatty solids, and ash ; but, in order that the results of one analyst may compare with those of another, the processes employed for determining these data require to be uniform, and the methods themselves must be such as will yield accurate results.

As proceedings under the Adulteration Acts are of the nature of a criminal prosecution, it is essential that the analysis should not indicate mere comparative results, but that the constituents relied upon for forming an opinion should be expressed by those weights or percentages which shall set forth the true quantity in the substance analysed, as absolutely as the most skilful analysis can provide.

About 6,300 samples of milk are analysed yearly in England, of which 20 per cent. are returned as adulterated. The offences are practically confined to addition of water and abstraction of cream, but occasionally preservatives, such as boracic acid, designed to prevent the milk from turning sour, have been found, and also, but still more rarely, sugar and colouring matters.

While admitting that in some districts the milk-sellers may be adequately sampled, yet, taking the country as a whole, the total number of samples analysed appears to me to be insufficient to show to what extent adulteration is generally practised, or to act as an effective bar to the practice.

Butter.—The supply of good, wholesome, and genuine butter for the public use is a desideratum. Fortunately, however, in this they are able in a great measure to become their own judges. They can readily distinguish between what is sweet and rancid, and can discover a butter which is heavily loaded with salt, and often detect the presence of an excessive amount of water. In fact, the public can practically protect themselves against most forms of butter adulteration, except that arising from the admixture of foreign fat.

Butter is another illustration of the difficulty with which chemists have to contend, arising from the wide variation in the composition of the article in a pure state ; and, as in the case of milk, it is essential that, in order to avoid differences in results, and contrary opinions, the method of analysis adopted should be such as to effect a complete and accurate separation of what is termed the soluble and insoluble fatty acids. It is now generally admitted that the percentage of fixed fatty acids found in genuine butters varies from 85·5 to nearly 90·0 per cent., so that the addition of something like 40 per cent. of a carefully selected foreign fat to the richest butter, would still leave the percentage of insoluble fatty acids within the range of a genuine butter.

As in the case of milk, chemists are agreed upon the lines to be followed for the determination of the genuineness of butter, and differences can only arise from variations in processes followed for the attainment of the necessary data.

About 1200 samples of butter are analysed yearly, of which 15 per cent. are reported against. The adulteration consists in the substitution or admixture of foreign fats, and occasionally in the introduction of an excessive amount of water.

In connection with this subject, I may mention that the manufacture of artificial butter compounds from animal and vegetable fats has, in recent years, attained enormous proportions in the United States of America. These compounds, known as butterine, oleomargarine, suine, &c., are in the opinion of high authorities legitimate articles of commerce, if sold under names which properly indicate their origin and composition.

If manufactured in a cleanly manner from sound fats, they are perfectly wholesome, and afford the poor a cheap and useful substitute for butter, especially during the winter months, when good butter is both scarce and dear. I see, however, that the Legislature of the State of New York has, at the instigation of the farming interest, resolved to suppress the manufacture and sale of such compounds within the bounds of that State.

This decision was based upon the evidence given in what is said to have been a very one-sided investigation, and in which it was stated that such compounds contained deadly germs ; that the workmen engaged in their manufacture were subject to loathsome diseases ; and that by their use the death-rate of New York had increased at an alarming pace. Putting aside such undoubtedly exaggerated statements, it is highly probable that with the increased demand there may have been less care exercised in the manufacture than at first, and that in some cases impure or decomposed fats may have been used, but these are grounds rather for sanitary supervision than for the suppression of the trade.

Cheese.—It is considered that the consumer can in a great measure protect himself in his purchases of cheese. The range of prices plainly shows him the different qualities, and he can exercise his judgment in selecting the kind best adapted to his taste and pocket. I am not aware of any instance in which an adulteration of cheese has been reported. Colouring matter is about the only foreign ingredient employed in its manufacture, but this is a necessity to satisfy the public taste as regards colour.

The successful manufacture of factitious butter from animal and vegetable fats has naturally suggested their substitution for milk fat in cheese, but there is no evidence that "butterine cheese" has yet found its way into the English market. When it does, there are adequate chemical tests to distinguish it from the genuine article.

Bread.—About 1100 samples of bread are analysed annually, of which, on the average, 6 per cent. are shown as adulterated. The principal adulterant is alum, which was reported in one case as being present to the almost incredible amount of 1305 grains, or nearly 3 ounces to the quartern loaf. I do not think it would be questioned that so large an addition of alum must be injurious to the health of the consumer. The amount usually added, however, is comparatively small, being only about 30 to 40 grains in the 4-pound loaf, and whether then injurious to health or not is a matter in dispute, there being both chemists and medical men who take opposite views on this subject. When the objects for which alum is added are considered, that it is either to enable unsound flour to be used, or to cause the bread to appear to have been made from better flour than has really been the case, its use should be strongly deprecated, and its presence treated as an adulteration.

Tea.—The number of samples of tea analysed by public analysts is small, and the cases are very rare in which adulteration is reported. This, no doubt, in part, arises from the scrutiny which tea undergoes on importation, which has had the effect of discouraging, in great measure, the trade in adulterated teas.

The manufacture in this country of spurious teas from the leaves of other plants, or from exhausted tea-leaves, is extinct; for the low price at which genuine tea can now be sold holds out but small inducement for the increased risk under the present adulteration Acts, of manufacturing and selling a spurious article. The methods of analysis adopted for the detection of the adulteration of tea are fairly effective, and the only form of sophistication which could be practised with any chance of success is the admixture by the Chinese of partially exhausted tea-leaves.

Coffee.—About 1250 samples of coffee are yearly analysed of which 18 per cent. are reported as adulterated. With rare exceptions the sole adulterant found is chicory, which, it may be mentioned, is the only substance that can legally be added to coffee without requiring the payment of a further tax in the form of a stamp duty.

The adulterants of coffee all consist of vegetable matter, and allowing that the analyst is acquainted with the structure of the different vegetable tissues, their detection by the microscope becomes a matter of certainty.

In connection with coffee it may be noticed, and the remark applies equally to all substances on which a Revenue duty is imposed, that the interests of the public are largely though indirectly protected by the constant supervision and inspection which such commodities undergo, either in their manufacture or sale, so that before such articles in the adulterated state can come into the hands of the public analyst they must have evaded those safeguards which the restrictions of the Revenue Acts provide.

That such a result is brought about receives confirmation from the fact that it is seldom that a prosecution arises under the Food and Drugs Act, for the adulteration of a dutiable article with a marketable commodity not liable to duty.

Spirits.—Whisky, gin, rum and brandy are the only articles under these Acts which are required to be sold at not less than a specified strength, unless otherwise declared at the time of sale.

These spirituous liquors are in a different position to natural products, for being in all cases mixtures of manufactured spirit and water, the relative proportions of which are readily ascertainable, it was not unreasonable for Parliament to fix a minimum proportion for the essential constituent alcohol (defined in terms of proof spirit), below which the retail purchaser was to be considered "prejudiced," unless made aware of the fact at the time of sale. It is true that the percentage of alcohol is but one factor in determining the commercial value of spirits, and that a purchaser may receive better value for money in a well-matured spirit below the minimum strength, than if he were supplied with a less-matured article at or above that strength. The alcoholic value, however, is the only one which can be accurately estimated, and about which, therefore, analysts may fairly be expected to agree.

About 2000 samples of spirits are annually analysed, of which 25 per cent. are reported as adulterated, but only in very isolated cases has any other adulterant than water been found. This is a striking refutation of the opinion, so frequently expressed, that most of the evils of spirit drinking are due to adulteration, and no better illustration could be afforded of the frequency with which inferiority of quality is confounded with adulteration. On several occasions samples of whisky have been sent to me from districts where the people were said to have been injuriously affected by drinking the spirit, and I have never met with an adulterated sample, but the spirit was invariably of a raw and immature character. The changes that take place in the maturing of spirit whereby it loses its fiery character, and the deleterious traces of fusel oil, become changed into comparatively harmless flavouring ethers, are not well understood, and it is impossible by any mode of analysis at present known to separate spirits into the two clearly defined classes, of those which are new and deleterious, and those which are sufficiently matured as to be harmless, this being rendered all the more difficult by the common practice of blending spirits of various ages and flavours in order to get a mixture having a certain recognised character.

In some measure, to meet this difficulty, an effort was made a few years ago by a well-known Irish member of the House of Commons, an effort which is now being renewed, to move the legislature to enact that whisky before being sent out for consumption must have been kept in warehouse for at least one year. This attempt, however, did not succeed, through the trade difficulties which were found to beset such a plan.

The obstacles in the way of controlling the quality or genuineness of brandy are even greater than in the case of whisky, as its production is carried on outside this country, and the practice of adding a certain proportion of plain spirit and a mixture of sugar and flavouring matter to real brandy, has become fully recognised in the trade, and is allowed for in the purchase and sale of this article.

This addition of saccharine matter has a marked tendency to obscure the naturally harsh character of brandy, and to cause its coarse and immature nature to pass unnoticed by the public generally, while whisky being free from sugar at once appeals to the palate in cases where the spirit is of a new or fiery character.

That the circumstances indicated create formidable difficulties in the application of chemical tests to brandy suspected to contain added spirit is clearly evidenced from the fact that there does not appear to have been any successful prosecution under this head in connection with the Food and Drugs Act.

Beer.—This, from its position as the national beverage of this country, is of especial interest and importance in its relation to analysis and adulteration. Prior to 1847 beer could be accurately and legally defined as a fermented beverage prepared from malt and hops, but in that year sugar was allowed to be used. Fifteen years later, namely, in 1862, the hop duty was abolished, and revenue interference with the use of hop substitutes ceased; then, in 1880, the malt duty was removed, and brewers were allowed by the Beer Act of that year to use any materials whatever capable of being used in brewing. There is no legal limitation as to the strength or original gravity of beer, nor as to the degree to which it shall be fermented, or, in other words, the proportion of alcohol it shall contain. It is, therefore, impossible to give a clear and concise definition of what beer ought legally to be. The former definition and still popular idea, that it is a fermented beverage prepared exclusively from malt and hops, is neither supported by revenue law nor by present trade practice, for there may now be legal beer without either one or the other, or even without both.

Under what circumstances then can a purchaser of beer be deemed to be prejudiced? The Local Government Board have stated that "it would seem to follow from decisions in the High Court of Justice that a purchaser in demanding beer must be held to mean the article ordinarily sold under that name, and that it would be to his prejudice to sell him, as beer, an article not of the nature, substance, and quality of that ordinarily sold as such, whether containing ingredients injurious to health or not." It is not easy to fix a basis or standard of quality for the article ordinarily sold as beer, for it is my experience, as well as that of other analysts, that even in the same town the money value of beer sold under the same name, and at the same price, differs by as much as 50 per cent. from whatever point of view its value may be considered. Suggestions have been made that, as in the case of spirits, minimum limits of strength, based upon original gravity, should be laid down by Parliament for the several well-recognised sorts of beer; but there would be many objections to such a course, more especially where the value of the beer depends more upon its character or flavour than upon its stength.

An Association has been formed to cause the ingredients from which the beer has been made to be declared, but I fear that those who expect analysts to be able to prove or disprove the truth of such declarations rather overrate the present capabilities of chemical science.

A popular notion has long prevailed that no article is more manipulated than beer, and it is therefore satisfactory to find that there have been comparatively few prosecutions for the adulteration of beer, and, so far as I know, the only adulterant found has been common salt. Now the amount of common salt naturally present in beers varies widely, some of those containing the largest proportions being held by the public in high repute. As salt is added as an antiseptic, and really increases the keeping properties of some beers, it has been contended that the public cannot have been much prejudiced in those cases where a small quantity has been added, but where the total amount present is within the limits of a genuine beer held by them in high estimation.

It was my intention to discuss in detail several other subjects of interest, including wine, but it appeared to me that if I did so, the paper would prove too lengthy and tedious for the opening of a Conference.

I may say, however, that in most articles of food there has been a very great improvement in recent years as regards adulteration, and that the gross and deleterious forms of sophistication which are stated to have been extensively carried on at one time are now practically abandoned.

For example, the only substances which are now found in cocoa are sugar and starch, and in mustard, flour and turmeric, and these additions are not considered as adulterants so long as the preparations are not sold as pure or unmixed articles.

Again, in the manufacture of confectionery, not only has the use of earthy substances been discontinued, but the employment of pernicious colouring materials has practically disappeared, and harmless, vegetable colours are now almost universally employed.

Even in pickles and preserved vegetables it is now rare to find the colour heightened by the addition of a salt of copper, and the colour of cayenne pepper is no longer improved by the use of red lead.

In fact, in whatever direction we look, the same improvement is observable, judging from the Reports of the Public Analysts to the Local Government Board, and the absence of prosecutions.

Before concluding, I desire to express my opinion that the machinery provided by the legislature for the suppression of adulteration is fairly efficient, and only requires to be vigorously worked by the various local authorities in order to be productive of great good to the community. I trust that this Conference will be the means of stimulating these authorities to a more zealous administration of these Acts, and particularly of directing their attention to the advisability of obtaining samples for analysis from every part of their district, and with such precautions as will insure the purchase of articles in the state in which they are ordinarily supplied to the general public.

I cannot conclude, however, without expressing my sense of the efficiency of the work which has been, and is now being done by public analysts, not only in their official capacities, but in regard to their contributions to analytical science, of which their works on bread, milk, and butter may be cited as well known examples. It has been the least pleasant part of my duty to have to differ from them, as sometimes they have differed among themselves, at one time on actual results of analysis, and at another on the deductions to be drawn from practically similar results, but such instances should not affect the confidence with which the general ability and high services of public analysts ought to be regarded.

DISCUSSION.

The CHAIRMAN having thanked Dr. Bell for his very complete, interesting, and fair account, said he thought there would be pretty general agreement in several of the statements he had put forward. In particular he might take upon himself to declare how very largely the public was indebted to the labours of those many gentlemen who undertook very ably the office of public analysts, and how largely pure science was indebted to them for their labours. It was gratifying to hear from Dr. Bell that there had been so large an improvement in recent years in regard to adulteration, and that the gross and deleterious forms of sophistication which were stated to have been extensively carried on at one time were now practically abandoned. So far, therefore, the Adulteration Act may be regarded as a success. It must further be said that there could not be any doubt as to the sanitary evils resulting from the adulteration of food, and, therefore, in connection with the Exhibition they might congratulate themselves on the means of adding to the public health which had resulted from the working of the Act referred to. It would be admitted that, on the whole, the Acts had worked well; but a question arose whether they might not be made to work better, whether indeed in some particulars they did not imperatively call for amendment. If the question before the Conference was simply the repression of adulteration, it was quite obvious that the Acts might very considerably be amended in respect to their efficiency; but other conditions had to be borne in mind as well, and they could not conceal from themselves that to a small extent in some places, and to a larger extent in others, Acts of this kind were more or less prejudical to trade and invention. All were interested in the supply of pure and honest food, but they were all interested also in not interfering with its abundant and cheap supply, or with the improvements in the mode of manufacture and productions of those articles of food which were more or less of an artificial character. He feared if the Act had been in force some forty years ago, what Dr. Bell had told them with regard to beer would have had no foundation, and that the supply and quality and cheapness of beer might have been very seriously interfered with by any very stringent and legislative enactment with regard to the materials from which it must be produced. But it was not for him to express his own view on any of these points, but rather to invite the opinion of others ; but he must refer to one or two points with regard to the possibilities of an amendment of the Act, with the view of inviting those with most experience of the subject to say how far they thought it necessary that it should be altered in certain respects, and how far it was necessary to amend it so as to insure its general applicability, because at the present time there were considerable portions of the country where it was not actually applied at all. If the Act were really doing good, it seemed a pity that it should not be doing so over the largest possible area. It appeared that the Local Government Board had power to enforce the application of the Act so far as the appointment of analysts was concerned, but not to insist on the appointment of inspectors, nor, on the other hand, to insure that a sufficient or indeed any number of samples should be analysed. In many cases, although the Act was to a certain extent in force, the number of samples examined was so small as really to have no influence on the character of the supply of the district. Another point hinted at by Dr. Bell was how far it was possible to secure that the articles submitted to the analyst were the actual articles supplied to the public in the neighbourhood. Here of course came the question how far the services of the inspector were neutralised by the publicity of his office, and how far it was desirable that samples purchased by private consumers should be analysed. Then again there was another point, whether the punishments inflicted on offenders were adequate, and whether the same limitation to the reduction of the fine as applied in the case of offences against the Revenue Laws should not also apply to repeated convictions under this Act. Another point which naturally suggested itself was, how far the Act should be increased or diminished in stringency ; for instance, as Dr. Bell told them, beer was qualified only by this definition, that it must be the article ordinarily sold under that name, and the question was whether matters should be left in that state with regard to beer, and if so, whether it might not be desirable to leave them in the same open state with regard to other articles of a more or less manufactured nature. It might or might not be right in the case of beer, but if it were, the question arose, why should it not be right for butter or for cheese ? If a tradesman were allowed to sell as beer anything which was held to be the article ordinarily sold under that name, why were butter and cheese not to be equally the articles ordinarily sold under that name ? It might be desirable to put these latter articles on the same footing as beer, or, on the other hand, it might be desirable to put beer on the same footing as them. Another question was, how far the use of chemical agents as preservatives was allowable. They knew that beer of very high repute did contain the chemical substance called bi-sulphite of lime, and he did not know that any brewer had been interfered with for using that article, but, on the other hand, they knew that dealers in milk had been interfered with for using boracic acid, which seemed to be an anomaly. In the same way with regard to bread. At one time an artificial powder made of tartaric acid and bi-carbonate of soda was largely used in making bread, and afterwards bi-sulphate of lime was used as a substitute for the tartaric acid ; and at one time bread was made largely in the neighbourhood of Manchester, in which carbonic acid gas was made by the introduction of pure super-sulphate of lime and carbonate of soda. It was a question whether chemical agents of this kind should be allowable and to what extent. Another point which he would venture to put forward was, how far the Adulteration Act might be extended so as to include food for cattle, and how far, moreover, the work of public analysts might not be directed to a considerable number of articles of food which were rarely, if ever, now examined ; such, for instance, as syrups and fruit essences, many of which were made from artificial chemical products, and, again, the class of mineral waters. Another point of some delicacy, but of considerable importance, was how far the mode of settling differences of opinion or differences of statement between analysts was altogether satisfactory, or how far it might be possible or desirable to improve it. The mode adopted of referring these matters to the Inland Revenue Chemical Department was no doubt a very unusual method ; in most other cases a chemist on one side, and a chemist on the other set forth their different opinions, and a judge or jury had somehow or other to decide the matter between them. Occasionally these opposite views were referred to some particular expert to act as referee, but it was only done by the consent of both parties. In the case of adulteration of food there was an official referee, and on the whole they would all feel that he had done his spiriting very gently. Then came the very important point raised by Dr. Bell, as to the desirability or not of fixing the limits of quality in such articles as milk and butter, which though genuine were susceptible of very great variations in quality, so that putting aside the idea of legal prejudice, a customer might really be more prejudiced by buying an inferior genuine article than he might be by buying articles of high quality subjected to a greater or less amount of adulteration. Dr. Bell had already intimated his view on this point, that the adoption of limits of quality might lead to some difficulties, but other persons might have a different opinion. A question would arise, how far any regulation of this kind would limit the supply if, as had been suggested, the rise of ½ per cent. in the non-fatty solids of milk would really have the effect of reducing the supply by 10 per cent. ; no doubt they would all agree that it was very undesirable to do so, but opinions might differ whether or not it would necessarily have that effect, and whether the inferior qualities of milk might not be made use of in some similar way to what was called the mingling of brands in other articles. No doubt Dr. Voelcker would be able to give some idea if a limit of quality were fixed, whether it would interfere with the abundance of supply. Then would come another question, how far it would affect the average result. It might reduce the highest qualities of milk to the lower standard, but even if that undesirable effect resulted, the influence might on the whole be good by improving the general average. At the same time it might be possible to have in the market more than one quality of milk; they might even perhaps suppose that milk dealers would sell milk guaranteed to be of a certain quality with a certain percentage of non-fatty solids, a certain amount of cream, and so on. Then came another point also raised by Dr. Bell, the difficulty of analysis by reason of the variety of natural substances, and the question, what should be the standard taken in the case of milk and in the case of butter. They all knew that very considerable differences of opinion had arisen, and had led to some rather warm discussions with regard to what should be the standard which should serve as the means of expressing the proportion of water added to any particular milk. Then came the question of different modes of analysis, and it would be for the meeting to decide whether that subject should be discussed; but they might certainly consider the point whether it was desirable, in all cases where practicable, to obtain results which were expressible in exact percentages and not rely on mere comparative results. Another point was that some of these adulterants were added with the object and result of improving, as a marketable and eatable article, the materials of the food to which they were added, and a question of considerable importance, how far these effects might be produced without the aid of adulteration; for instance, in the case of bread, they all knew that alum aided in producing a much more presentable loaf than could be obtained without it, but the question was how far could that appearance be obtained without the use of such an objectionable adulterant.

Dr. VOELCKER said it was impossible to discuss the many points to which the Chairman had alluded, though they all needed discussion before any amended Act could usefully be brought in. On the general point he would venture to express the opinion that a very great deal of good could be done if the adulteration of cattle food were included, for no one could have an idea of the extent to which the adulteration of cattle food was systematically practiced in England, more especially linseed cakes, which were so largely used for the production of milk and fattening of cattle. It was true that in late years, owing to the Royal Agricultural Society of England, who had taken a very bold step in some cases of publishing the names of offenders, the adulteration of cattle food had somewhat diminished, but it still existed to a great extent. Taking linseed, rape, and other cakes of a definite character, leaving out mixed cakes, which were professedly sold as mixed, a very large proportion were adulterated. In the same way, feeding meal, such as refuse from rice mills, Indian corn flour, and the refuse of starch manufactories, was very greatly adulterated, and a deal of harm was done to cattle. Every year he got a great many samples of rice meal, adulterated with gypsum and bran and pollard, which was sold for feeding pigs, and of course filled them. A good many cows, too, were yearly poisoned by adulterated rape cake; one-half of the linseed cakes, even those which professed to be pure, were not genuine pure cakes. At the same time there was no difficulty in obtaining reasonably, commercially pure linseed, containing not more than 5 per cent. of foreign matter, such as small bits of sand or seeds. A few years ago there were a few mills which produced pure linseed cake, but at present they were more numerous, still a great deal of good would be done if the Act were extended to cattle food. In his capacity as Assistant in Chemistry to the late Professor Johnston, of Edinburgh, subsequently to an experience of fourteen years at the Royal Agricultural College at Cirencester, and his experience as Consulting Chemist for twenty-six years to the Royal Agricultural Society of England, had brought him in close contact with all matters in connection with dairy farming and the production of butter and cheese, and he would therefore say a few words on the production of milk. It had been stated that it would be a great advantage to fix a definite standard quality for milk, and in some measure it would be, provided it were fixed high enough, and that standard were fixed on a reasonable and sound basis, not, as had been done, on questionable analyses and experience. The present standard by the public analyist was too low, and he was of opinion that from one-half to three-quarters of the milk sold in London and other towns was partly skim milk, not the natural substance as the cow furnished it, especially in the strawberry season, when garden parties were common, because a good deal of the cream was taken off. At the present time very reasonably good milk might be expected, not of course such rich milk as that furnished by Jerseys and Alderneys, which often contained a much higher percentage of fat than the maximum mentioned by Dr. Bell; but of course you could not expect to get that at 4*d.* or even 5*d.* a quart. A large percentage, however, of pure milk was partially skimmed, owing to the fact that public analysts had fixed the standard, which they had published or made known amongst the trade, at 2½ per cent. of fat; on the other hand, 9 per cent. of solids, not fatty, was too high, and this figure had been fixed on the basis of an imperfectly dried milk residue. Of course, if the water were not all driven out, the residue would be larger than it would be if it were dried perfectly. The difficulty of fixing any standard arose from the fact that milk was subject to such great variations. At certain times of the year milk was poorer than at others; for instance, in the spring of the year when the fresh grass was coming in, being very watery, it would not produce such rich milk. Still, with all these variations, a certain minimum quality ought to be insisted upon, and he thought that 3 per cent. of pure butter fat and 8 per cent. of solids not fat, would be a very good standard, and few dairymen would find fault with it. Another danger in fixing a standard was that dealers would work up to it. He one day asked the dealer why he did not give more cream, and the reply was that he was compelled by competition in the trade ; that he could give milk with 3 per cent. of cream, but the others did not do so, and therefore they kept it to the standard. One man said they could not go on with the business if they did not keep a chemist on the premises. He was by no means unfriendly towards his own professional brethren, but he could not see the necessity of having an analytical chemist employed to work up to the standard required by public analysts, and thought it would be much better to have the milk pure. As a rule, milk dealers took care of themselves, and did not supply the public with richer milk than they were compelled to. He did not think Dr. Bell was quite accurate in saying that no cheese partially made with butterine had as yet found its way into the market. He was sorry to say a good deal did so, and the exportation from America of oleomargarine cheese was very considerable and increasing. There was something to be said for this cheese ; he had himself tested it, and as long as it was sold for what it was there was no great objection to it. The same with regard to the oleomargarine used in the manufacture of Dutch butter ; about 100 tons were exported every year to Holland, manufactured there, and came back to England as the best Dutch butter. So long as an article of food was sold for what it was, and the materials employed were of a wholesome and inviting character, he did not see any objection. A great deal of cheese in England was unsaleable, especially that made in localities where there was no sale for the milk. There was great trouble in disposing of the skim-milk, and skim-milk cheese only fetched from 3½*d.* to 4*d.* a lb., but with the addition of oleomargarine it could be made into cheese which could be sold for 8*d.*, which was certainly a more profitable way of disposing of it, and perhaps no great injury was inflicted on the public. The great desideratum was that the thing should be sold under its right name. In conclusion, he would offer a word of caution to analysts, who he had no doubt had been doing a great deal of good. The adulteration of food had certainly greatly diminished, owing to their exertions, and their duties were more and more recognised by those in authority. It was from no wish to find fault with them that he remarked that perhaps a little more caution would sometimes be desirable ; that they should not jump to a conclusion simply because they found a certain reaction was produced, that a certain thing was present which had really nothing whatever to do with the character and value of the article under consideration. Only a few days ago a sample of cream had been referred to him which had been pronounced by the public analyst to be adulterated with starch, and of course his impression was that starch in the shape of a thick paste might have been used with the view of making the cream look thick. He tested it in the usual way with tincture of iodine, and found that the quantity was so small that he knew at once no starch could possibly have been added to the alleged adulterated cream. Taking several portions, in some he found traces of starch, and in others he did not, and examining it under a microscope, he found that where he got a starch reaction there was a solid starch granule or so, and it struck him there could not possibly be any appreciable quantity of starch, and that possibly it might be due to the fact that the cream had been strained through a linen cloth, and on further inquiries he was confirmed in his opinion that that was the right explanation. In another case which recently came under his notice, a gentleman sent him some cream which he said threw down a purple colour, and he thought something dreadful had happened. However, under the microscope and subsequent chemical tests, he readily found out that there was some aniline dye present, and, writing for further information, it turned out that the dairymaid had strained the milk through a red-coloured calico. In such cases, to jump to the conclusion that some frightful thing had been practised on the cream would be totally wrong. At the same time he did not say that the use of red-coloured calico was not objectionable.

Mrs. SEDDON asked if there was any society for the purpose of paying the expense of analyses for poor people who could not afford to do so, and also if there was a public analyst at Ramsgate.

The CHAIRMAN said there was a public analyst for Ramsgate, who lived at Canterbury. There was no society for the object named.

Dr. DUPRÉ said that public analysts had so rarely the opportunity of bringing their case before the general public that he gladly availed himself of this opportunity of setting forth their side of the question, and he hoped there might be present both manufacturers and dealers who would give their opinion from the opposite side. There was no doubt that adulteration had greatly diminished, more particularly in such articles as came more under the operation of the Act, such as bread, milk, spirits, and coffee, &c., but the effect of the Act had not been anything like as great as it might have been, for various reasons. First and foremost was the apathy of the general public. The Act was passed primarily for the protection of the general public, and secondly for the protection of the honest trader, to protect him against unscrupulous rivalry ; but unfortunately this primary object of the Act seemed to be forgotten by many persons, and public analysts as a rule received no support whatever from the general public, either by having samples brought to them to be analysed or by an expression of opinion in favour of a proper carrying out of the Act. The result was that the analyst found himself opposed by those who practised adulteration, not by any means a small class, and also by certain associations, some old and some new, which ought to look on the analyst as the greatest benefactor, his object being to suppress adulteration, but they did not seem to do so, and consequently, whenever any one of a particular trade was attacked, they went in with counsel and witnesses and all the machinery of the law to stop the prosecution, and the public analyst, not having any support, often failed. His real position was often misunderstood by the public and by the tradesmen directly interested. His sole function was to analyse any article of food, drink, or drug brought to him by either an inspector or by any one appointed under the Act, or by any one of the general public who complied with the provisions of the Act, which were to the effect that, at the time of purchase, he must tell the dealer that the article was to be analysed, and must offer to divide it into three portions. The public analyst had nothing whatever to do with buying the article, or with any subsequent prosecutions; he simply gave his certificate, and, if necessary, he must be ready to give evidence as to the truth of the certificate in the witness-box. He had nothing to do with any prosecution, and in fact occupied a position of absolute neutrality. The second cause why the Adulteration Act was not as effective as it might be was on account of the low fines frequently inflicted. He could not illustrate this better than by referring to milk, which was an article of primary importance, on which depended the lives of thousands of children, yet it was one of the most largely adulterated, owing partly to the ease with which a man might go to the pump or water-tap. This only seemed to him to render it desirable that, if adulteration of milk were proved, the fraudulent dealer ought to be punished severely. But what did they find? If a man added only 10 or 20 per cent. of water, he was fined 5*s.* or perhaps 10*s.* What was the meaning of the fine of 5*s.*? it meant simply the sale of 12 quarts of water in the shape of milk, so that, if he added 10 per cent. of water, the sale of 15 gallons of adulterated milk would pay the fine. Now, in the nature of things, it would be quite impossible to frequently analyse the milk of the same dealer; it would be scouted as persecution, and the result was that, before the milk inspector came round again, the fraudulent dealer had long ago recovered his fine, so that such a low fine, instead of a deterrent, was actually a premium on adulteration. To show what might be done if the public took more interest in the matter, he might say further, that in his district inspectors used to be in the habit of going round, and when he had been, in two successive weeks the milk used to come up to a very good standard. It was once suggested that they should go on the Sunday, and the result was that the adulteration of milk, which on week days was one in six for several years, turned out on the Sunday to be six in seven; almost every sample bought on the Sunday was adulterated. Next Sunday every sample obtained was genuine. He had not the slightest doubt that if the public would occasionally bring samples to the analyst for examination, this adulteration would be considerably checked. With regard to the standard, the society of public analysts had never fixed a standard, they had fixed a limit below which no milk should be considered genuine. There was no question about it that the fixing of such a limit was a great difficulty; milk did undoubtedly vary within tolerably wide limits, but this variation was confined to a very few animals. You might occasionally find the milk of a single cow which fell very much below the limit, whether the cow was in a state of health or not, or had been properly fed, he would not say. But was it right that the general public should be deprived of their proper quality of milk because sometimes a single cow gave a milk which fell below that standard. If it were the case with a single cow, it was never the case with a whole dairy. He desired to speak with the highest respect of the officials of Somerset House, who did a difficult work with remarkable ability, and, on the whole, with considerable success; but on the question of milk he could not help thinking they had made a mistake, and that it would be a great injustice if Londoners were restricted from getting their milk up to the standard of 9 per cent. Another point was this, the word "adulteration" was not mentioned in the Act, it simply said the article should be of the nature, quality, and substance demanded, and it would be well if the Act throughout kept to that definition, and did not require of the analyst an impossibility; but, unfortunately, the schedule appended to the Act, which gave the form of certificate which must be used by the analyst (and must be literally followed, for if a single word were left out it might lead to objections being taken and a failure of prosecution), said the analyst must certify that such and such a foreign ingredient was present in such and such a proportion. Now, he might say, without fear of contradiction, that though it was often possible to state that a substance was not of the nature, quality, and substance demanded, it was perfectly impossible to state what was the nature of the ingredient added, and still less to say what was the absolute quantity added. He thought, therefore, the Act should be amended in that respect, and that the analyst should have the option of stating that the article submitted to him was not of the nature and quality demanded, but that he was not able to state the exact nature and absolute quantity of the article added. Take the case of wine ; it was comparatively not a difficult matter to say whether the colour of red wine was genuine or not, but is was nearly almost impossible to say what was the nature of the colouring matter added; in some cases it could be done, but in others it could not, and therefore, in such a case the only option the analyst had was to pass over such an article, for if he varied from the form of certificate, the prosecution would fail. A great many articles had to be passed simply because the analyst was unable to state what was the quantity of the adulterant. There was no doubt the present form of certificate was a great stimulant to research, because no one liked to fail, and every one was anxious to devise methods which would enable him to state what was the exact nature and absolute quantity of the adulterant. But as long as that was not possible, he did not think the law ought to ask them to state what was really an impossibility. Dr. Voelcker thought public analysts had raised the standard of milk too high in one respect, and too low in the other, namely, in the cream ; but why had they done so? Because they were not sufficiently supported by the public, and if the unfortunate analyst gave a certificate that milk containing 2·5 or a little cream was adulterated, down came some association and a number of witnesses, to prove clearly that that was all matter of necessity or of accident, and that if you went on taking milk from the top of the churn, you naturally went on skimming it, and if you came to the bottom, the cream must have been removed. It might not have been removed fraudulently, but still it had been removed, and the result was that the public had to take bad milk. Everybody could skim milk, but it need not be done, and if a dealer were thoroughly honest he could easily mix his milk before the sample was taken.

He had made many experiments, showing that if you had milk with as much as 5 per cent. of cream, you could go on dealing out four or five gallons without reducing the cream. With regard to the question of whether anything should be added to preserve articles of food, at first sight it seemed quite right to allow it, but on a little further consideration grave doubts would be engendered, whether in the case of milk that was right or not. Milk was fortunately an article which had to be handled and treated with very great care, and unless the dealer were cleanly in all his apparatus and business, the milk would all turn sour. But if he were allowed to use anything to keep the milk, the public would lose to some extent that safeguard, and business might be conducted in a slovenly manner, and the milk kept in dirty rooms, without showing it, by turning bad. He thought this property of milk was very fortunate, and one of the great safeguards; for if you had milk which kept a reasonable time, it was an indication that it came from fairly healthy cows, and had been properly dealt with. In the second place, the milk dealer could not skim much cream unless he used a centrifugal machine for making the milk turn, and he noticed in his district that whenever they had milk with a sufficiently low proportion of cream, there was generally boracic acid in it. He had no doubt that had been added in order to allow of the milk being kept standing sufficiently long to skim it without running the risk of its turning sour. With regard to spirits, it was often said that young spirits were injurious to health, because they contained fusel oil, but there was absolutely no evidence to support it. Nobody had ever yet proved by analysis that young spirit contained more of this supposed deleterious ingredient than the old. Some years ago he had to analyse some Cape Smoke and Sanchou from China, which played great havoc with the English sailors there; the idea was that these deleterious effects were due to an improper proportion of fusel oil, but it turned out that it contained a smaller proportion than English whisky. Some years ago there was some considerable discussion on this point in Sweden. The Swedes seemed to be given to a great extent to brandy drinking, and it was stated in public that the many injurious effects were due to drinking fresh spirit with fusel oil in it. A commission was appointed to examine into the matter, but there was no evidence to prove that it was due to fusel oil, but that as a rule the young spirit was so much liked by the populace that they drank considerably more of it than they did of the old, and therefore the injurious effects were due to the increased quantity taken rather than to the bad quality. He hoped this Conference would to some extent arouse the interest of the general public on this question, for he was firmly convinced that it was only by a fair co-operation of the public with the public analyst that adulteration could ever be suppressed.

Mr. WIGNER (President of the Society of Public Analysts) said his own opinion was that Dr. Bell had taken rather too favourable a view of the action of the Act up to the present, and although he agreed with him that it had done a considerable amount of good, he did not look on the amount of good yet done as being nearly sufficient for the machinery put into play. It was something very little short of a disgrace to a country like England, after having an Adulteration Act at work for eight or nine years, to find the average of adulterated articles sold should be 17, 18, or 19 per cent., varying a little with the class of goods. Dr. Bell had quoted from the statistics given in a recent book of Mr. Herbert's, but he was sorry to say those statistics were not so full as was desirable, and in some respects they were not by any means accurate. He had a few other statistics which would illustrate that point. Taking the seven years from 1875 to 1881, the reduction in the percentage of adulteration had only been 18·1 to 16·6, a very unsatisfactory result for seven years' work. Taking, again, the adulteration of milk, it had increased since 1879 by nearly 3 per cent., and grocery, the next important article, only showed a reduction of 2 per cent. It was clear therefore that an alteration in the Act was wanted, and he very strongly advocated that alteration, taking the form of schedules, or standards of purity, of such a character that the very inferior articles, such as some speakers had referred to, should be excluded, even at the risk of a little inconvenience. For instance, there was just as much reason for excluding from retail sale milk which had only 8 per cent. of solids, not fat, if produced by an underfed or badly kept cow, as if produced by the actual admixture of water. If the cow were incapable of producing better milk, then she ought to be sent to the knackers, rather than be used as a milk-producing machine. He thought they might learn something from other countries. England took the lead with the Act of 1875, but that was the result of a compromise, when the effect produced by the Act of 1872 had been too severely felt by tradesmen. It was said that that Act acted harshly, and no doubt it did in some instances; a Committee of the House of Commons was appointed, and the result was the Act of 1875; but it was introduced with this remarkable clause, that if any article sold was sold in accordance with the usage or custom of the trade, the vendor should not be proceeded against. That, which was struck out in Committee, was the basis of the whole Act, and was the reason why no standards or limits were introduced into it. Amendments were gradually introduced during the passage of the Bill through the House, and an effort was made, not only to introduce standards, but also to extend the Act to cattle foods, but this was defeated by the agricultural party. More than two-thirds of the United States were under Adulteration Acts, and they were all based on an uniform draft. There was in addition a national law, and, with two exceptions, all those States had limits, and, with one or two exceptions, all of those limits were those laid down by the Society of Public Analysts, so that throughout more than one-half of the United States it was illegal to sell milk that contained less than 9 per cent. of solids not fat, or with less than 2·5 per cent. of fat. Granting that Dr. Voelcker was correct, and that the fat standard might be raised, he had heard no complaints from America with regard to it. Inferior milk was no doubt used to make inferior cheese, and the public were, he believed, fairly supplied. Now, turning to France, the Parisian Act was a municipal one, much more stringent than ours, and much more thoroughly enforced, but the same standards had been adopted. Although that Act had been in operation for about five years, he had not heard of any case in which a successful appeal had been made against the conviction, which showed that in Paris the matter was looked upon more seriously than it was here. In that city, with a population less than half of that of London, there were twenty-four inspectors, who did nothing else than take samples. Their course of procedure was to go in couples to every shop, to examine every canister, jar, and package in the shop, selecting that which they thought fit, and taking it to the laboratory, and leaving the others; and the number of samples examined was from 800 to 900 a month, or about 10,000 every year, while in London we were content with 1200 or 1400 in the same time. The result of that on milk was, that in Paris the average of the adulteration was only 2 to 3 per cent.; while the average adulteration at the present day in London was 17 per cent. adulterated with water, and at least 17 per cent. by skimming; or, adding the two together, 34 per cent. of milk was adulterated in one way or the other. That formed the strongest reason for suggesting the use of a limit, and that it should be higher than the one adopted by Dr. Bell, who had adopted his limit on the basis of poor cows being legitimate machines for manufacturing milk. He thought most decidedly the other way, and that proper milk should be the milk of healthy fairly well-fed cows. The section which provided for the examination of tea in bond had certainly been of service, and the adulteration of one or two other things had been entirely suppressed. The effect of the change made in 1879, by which spirits had a fixed limit, had also produced an improvement. Passing to the important mode in which the Act was enforced, he would remark that the Local Government Board had power to appoint analysts, if the Local Authority refused to do so, but they had no power of enforcing any penalty if the Local Authority did not appoint; and, after they had appointed an analyst, they had no power to pay him any salary, and therefore the Local Authority could, and did, snap their fingers at the Central Board, and the consequence was that analysts were not appointed, because their appointments would be mere sinecures, as they would have neither work nor pay. The same thing applied to the number of samples which were purchased. It had been put forward several times by the Local Government Board that one sample per 1000 of population ought to be purchased every year—certainly a very moderate estimate —but that was something like sevenfold the actual number. The certificate of analysis was unquestionably a most complicated and cumbrous document. It was originally worse, but it was slightly improved in its passage through the House; but, unfortunately, that certificate was not made incumbent on the chemists at Somerset House, when giving reference certificates, and, as the result of that, differences had arisen in many cases. The Public Analyst, for instance, was compelled to state whether any change had taken place in the character of the sample which would interfere with that analysis, and it was notorious to everyone that, in nine cases out of ten, samples of milk became decomposed when sent for reference analysis. That fact ought to be put in the certificate, because it had an important bearing on a second point that that certificate had to say—not as they did now, that the analysis could, or could not, be confirmed, but to say, in many cases, there was nothing to show whether the analysis was right or wrong. He believed Dr. Bell would agree with him, that many cases occurred where they were utterly unable to say the Public Analyst was right, but were equally unable to say that he was wrong; and if that were the case, the weight of evidence should certainly go in favour of the analysis made when the article was fresh, and the conviction should stand, rather than a man who, in all probability had been guilty of watering the milk, should escape. The question had been raised as to the limitation of supply which would arise from raising the standard, and his feeling was that that limitation would be very small. It was quite true that some of the milk used in country districts—particularly at a great distance from London—which was used for manufacturing condensed milk and for cheese, would be withdrawn for those purposes. But the milk could just as well come as an imported article; and if the area from which the milk supply of London was drawn were enlarged by a very few miles—and it already extended to an average distance of thirty-eight miles from the outskirts—it would give the supply required to sell all genuine milk, instead of part genuine and part water. The sale of genuine milk was larger than was supposed, because the sale of high-priced milk was larger than was generally thought to be the case. He was sorry to hear Dr. Voelcker's remarks with reference to the necessity for more care on the part of the public analysts, especially bearing in mind that in the two cases which he cited—only one of which was the case of a public analyst—it would clearly have been the duty of the analyst to have condemned the cream. In the first case it was true it contained only a trace of starch, and the supposition was no doubt correct that it was derived from an unwashed piece of cloth or calico used to strain the cream; but if the dairyman had allowed a piece of calico dressed with starch, or other impurities, to be used to strain the cream, he deserved to be convicted under the Adulteration Act, and, if it were not wide enough to catch him in one way, it ought to be wide enough to catch him in another; and the same thing was certainly true in the case in which linen coloured with aniline had been used. His feeling was that they should pass some resolution which should strengthen the hands of those who would have to take it in hand, if an amendment of the law were considered desirable or feasible.

Professor ATTFIELD, F.R.S., said he should address himself to one only of the points mentioned by the Chairman, and that was as to the proportion of articles of food and drink which were said to be adulterated. The public drew rough conclusions from what was said at Conferences like that, and one very rough conclusion they would draw was that of any articles of food and drink which they had to consume, 15, 16, or 17 per cent. were adulterated. Now, he should not like it to go forth to the public that that was true; the truth was, that of the articles which had been examined by the officials under the Adulteration Act, 15, 16, or 17 per cent. were simply said to be adulterated. Now, taking the number of different articles placed on our breakfast, dinner, and tea tables, he thought they might say there would be 20 or 30 different articles so presented in the course of the day, and in the course of a year many thousands of distinct purchases were made for the household. Now, was it to be assumed that of those thousands of articles, 17 per cent. were adulterated? As a chemist, having had 25 years' experience of analyses of articles of food and drink, he protested against any such assertion. He had examined vast numbers of articles of food and drink, and a still larger number of drugs, and his deliberate conviction was that not one in 1000 was adulterated, and he could give, not only his experience, but statistics to support it. For the last ten or twelve years he had been the chemical adviser of a body of traders who were liable to be charged with adulteration, and he consented to advise them whenever they might be threatened with a prosecution.

In some 25 cases in which they had been so threatened he had advised that about 20 should be defended, and in the course of defending the actions in these 20 cases, where the matter had been brought before the various impartial tribunals to which such matters were referred, the prosecution of 19 had been dismissed. In several of those cases it had been a matter in which the local officials on the one side had been put into the witness box, and himself on the other (but he had to give no evidence at all), in which a few questions put by the counsel for the defendant to the witness for the prosecution had been sufficient to upset the case. He made no charges against any man, but at the same time no man was perfect. It was quite possible in those 19 out of 20 cases there might have been wrongful adulteration, but he could only say that the independent tribunals had said it was not so. Now, if out of 25 cases brought before him he was able to succeed, so that in four-fifths of them the prosecution would be upset, and that practically in the whole of those cases the defendants were found not to be in the wrong, if one were to draw an inference, it would be that out of 15 per cent. of cases of alleged adulteration you ought to take off about 12, leaving 1 or 2 per cent. of possible cases of adulterated food. He would not, however, make any such inference, for he questioned the wisdom of drawing any conclusion whatever from these figures.

Mr. HEHNER said, after the somewhat vigorous remarks of the last speaker, it would not do for public analysts to let the matter stand without some reply; for although Professor Attfield had disclaimed the idea of bringing charges against public analysts, yet with the fact that every year something like 16,000 to 18,000 samples were analysed, and something like one-fifth or one-sixth were declared to be adulterated, if they were told that only 1 in 1000 was so, the implication upon public analysts was a somewhat heavy one. This Act had been in operation about 10 years, and every year 16,000 to 18,000 analyses had been made, making a total of close on 200,000; of those 200,000 something like 30,000 were declared to be adulterated, on which prosecutions took place, and according to the hypothesis now put forward, wholesale injustice must have been inflicted. It was notorious that statistics could prove anything, but these analyses were not made to produce statistics. The aim of those who bought samples and submitted them for analysis was to do the greatest amount of public good for the least amount of money, and therefore the aim of inspectors was to catch as many adulterating tradesmen as possible. If the inspector went about, and only bought the best samples of food, and the analysts reported that out of every 100 samples he received 100 were genuine, the public would be misled, and the authorities would soon direct that no further operations should be undertaken under the Act. Therefore the inspector in his district did not endeavour in buying samples to get an average number of adulterations, but he tried with the small amount of money allotted to carrying out the Act to do the greatest amount of public good, and that was only to be done by trying to get at those who adulterated, not at those who notoriously did not. Professor Attfield seemed to be exceedingly fortunate. Of course he accepted what he said, that he only got 1 sample out of 1000 adulterated, but considering that there were something like 100 public analysts, and many thousand samples were examined, nobody with any fairness of mind would for one minute admit that this wholesale injustice had been committed over so many years; and therefore it only followed that if Professor Attfield had been so fortunate as to escape getting adulterated samples, someone else must have had them in an increased degree. That was specially the case with the poor people who bought their goods in pennyworths, or small quantities. It would be as easy to buy 100 genuine samples as to buy 100 adulterated, and therefore he admitted the statistics did not go for much; they only showed that out of so many samples examined 16 per cent. were found to be impure. Again, although it was shown that the adulteration had not greatly diminished in percentage, yet every public analyst had noticed the decrease in the amount of adulteration. Five or ten years ago, samples of milk were frequently met with containing from 25 to 50 per cent. of water ; but now it was exceedingly rare to get anything which contained 20 per cent.—10 to 12 per cent. was much nearer the average amount of adulteration. On the whole, adulteration in our days meant something quite different to what it did ten years ago. Fifteen years ago, vermilion, chromate of lead, and other poisonous substances were frequently used, but in our days poisons were no longer met with ; in fact, as had been said, only cheating and not poisoning now took place, and if that was not an improvement effected by the Food and Drugs Sale Act, he did not know what could be. It was notorious that altough the Local Government Board could insist that an analyst should be appointed, there was no power to insist on samples being purchased for analysis, and there was a very considerable portion of the country in which no samples were examined. In one town that he knew the Act was not enforced, whilst in the country all round it was. In the country no adulterated articles would be sold, but as soon as the milkman passed the borough boundary, he could put his can under the nearest tap, because he knew there was no inspector about. In that respect the omission of compulsion in the Act did a great deal of harm. It should be made compulsory, not only as to the appointment of analysts, but in the purchase of samples, and in the proportion of samples to be purchased. It was not sufficient to get about ten samples a year, and even that was more than was done in some places. It must not be left entirely to the governing bodies, whose interest it frequently was not to have any samples analysed at all. He could mention a number of boroughs where there were a majority of people in the Town Council who dealt in food and drugs, and although an honest dealer might not mind having his articles analysed in some boroughs, the Act was not very strictly enforced. Dr. Bell had been extremely complimentary to public analysts, and on the other side he must acknowledge the amount of consideration which had been shown by the Appeal Court to which their cases were referred, and he was happy to say that there was a very considerable agreement between that Court of Appeal and Public Analysts, more so even than appeared. Every year, out of 25 or 30 cases referred to Somerset House, the analyses in only about half had been contradicted, but small as that proportion was, it was in reality much smaller, because it was frequently not a question of fact at all which was in dispute between the Public Analyst and the Court of Appeal, but simply a question of opinion. Nearly all cases in which disputes took place had been those of adulterated milk, and it frequently happened that the analyses of the analyst agreed entirely with that of Somerset House, only he came to a different conclusion from the figures. Of course, with so many thousand analyses there might be mistakes. Analysts were quite as fallible as other people, and perhaps more so, but the proportion of mistakes were very small, and there was this slight grievance, that they had to refer their analyses to a court of appeal, which really had far less experience in that particular kind of work than they had themselves, seeing that they analysed every year about 6000 samples of milk, whilst the Court of Appeal perhaps only analysed 600 altogether.

Professor DE CHAUMONT thought they might congratulate themselves, in spite of the partial failure of the Adulteration Act, that so much had really been attained. He could not take the roseate view which had been taken by one speaker, and say that in one article out of a thousand submitted to him for analysis there was no adulteration proved. In milk alone the experience of any analyst would have proved that the proportion was larger than had been stated. With regard to the question of how they should deal with cases of alleged adulteration, he quite agreed with what had been suggested by more than one speaker, that a great deal of loose statement was made with regard to the presence in articles of commerce of adulterants. For instance, in his own neighbourhood, Netley, he had been told that a good deal of the beer sold was adulterated with tobacco, but although he analysed seven samples, he had been unable to detect the presence of tobacco, except in one case, and in this instance he proved conclusively that it got in through the man carrying some tobacco in his pocket. One important point to consider was, whether they should deal with articles as avowedly prepared articles of commerce, as was understood to be done in the case of beer, or whether they should deal with them as articles that ought to be provided in a pure state. As a great number of articles were allowed to be used in the manufacture of beer, it was hardly possible to lay down any possible standard of what beer ought to contain, but this did not apply to butter or cheese. Milk ought to be sold as it came from the cow. At a Milk Conference that he attended at Gloucester, one gentleman suggested that milk should be taken as an article of commerce at a certain standard, and he considered it very hard if he had some cows yielding a particularly rich quality of milk that he was not allowed to take the cream off and sell the milk, which would then be equal to the usual standard. No doubt this would be very convenient for the trade, but exceedingly dangerous to the customers, as they had no security with regard to the means adopted, because water might be taken from the most polluted well in the country. As to butter and cheese, he thought they should be sold as pure articles. The Adulteration Act might be amended in this way, that no mixtures whatsoever with articles which could be provided as pure articles ought to be allowed at all. If coffee was sold under the name of coffee, it ought to be sold as pure coffee, and if people desired to use chicory, by all means let them buy it, and mix it themselves. The same principle might be applied to other things. The difficulties which the Adulteration Act had met with were many, and no doubt in earlier times one of the difficulties was the different modes of analysis, the uncertainty of the application of the guess made, and the necessary inexperience of analysts. All those were stumbling-blocks in the earlier days, but these for the greater part had now been got over. The Adulteration Act was above the standard of morality of the nation of the present time, in fact it was too respectable an Act for general outward application. He said this advisedly, for there were many tradesmen who would certainly scruple to put their hands into a person's pocket and take out sixpence or a shilling, who had no hesitation in putting water into milk or chicory into coffee. The immorality of the act was the same, but the public did not seem to think so, and magistrates seemed to look upon it as the custom of the trade to cheat, and that therefore the public ought to be content to be cheated. If a man were fined for adulterating milk one day, and again brought up a day or two afterwards, it was looked upon as persecution ; but supposing a man was punished for picking pockets, and he immediately resorted to the same practice, it would not be considered persecution if the police again took him into custody. Until they reached the point at which they could make it felt generally that adulteration was a distinct wrong against society, and not only a wrong, but a disgraceful wrong, there was not much chance of getting the Adulteration Act carried out to its full extent. In Paris and other parts of the Continent the Act was carried out in a more rigid way than in England. If public opinion could only be educated up this point, that a man who had been convicted of adulteration was publicly disgraced, then and not till then would adulteration be put a stop to.

The Conference then adjourned.

CONFERENCE ON JULY 15, 1884.

The Conference resumed at 2 o'clock.

Dr. MUTER said, in renewing this discussion he should not descend into the personalities or the contentious matter which had been brought up in the course of the discussion by those speakers who seemed to wish to run down the public analysts. Without going through the whole of the heads mentioned by the Chairman, he proposed to inquire first of all whether adulteration really existed to a marked extent before the passing of the Act of 1872, and whether that had been checked to any extent by the passing of that Act; secondly, he would inquire whether the Act, as it at present stood, ought to be amended, and in what direction, and whether standards and limits should be adopted; and lastly, he would reply briefly to the remarks made by one or two gentlemen yesterday. In the first place, on the question whether adulteration existed before 1872, and was that adulteration deleterious or merely commercial adulteration. Dr. Bell had already commented on the reports of the 'Lancet' Commission and other instances in support of the contention that adulteration did exist. Now he was one of the two or three remaining living analysts who really trained themselves to food analysis before the passing of the Act, and who had had practical experience in connection with a commission similar to that of the 'Lancet,' viz., the 'Food Journal' Commission. Looking back to the figures of 1870 and 1871, he found that out of twenty-three samples of coloured sweets then examined all over London by the editor of the 'Food Journal,' thirteen were coloured by a coating of chromate of lead, and three contained streaks of vermilion as well. As regarded mere commercial immorality, out of forty-seven samples of coffee bought as pure in that year, thirty-one were more or less mixed with chicory, whilst in seventeen cases the chicory itself was mixed with something else. He mentioned these facts to show that these things really existed—it was not mere hearsay, and he also asserted that the passing of the Act had produced a very great improvement; whereas in the districts in which he held appointments during the first few years after the passing of the Act, they could still get hold of these tainted sweets, they could not now do anything of the kind. For the past four years, out of many hundreds of samples he had examined, not one contained any deleterious colouring matter. He would even go the length of saying that the Act had entirely stamped out all deleterious adulteration, and that what now took place was rather in the nature of commercial immorality. In looking over the books of the South London Public Laboratory, where the business was done for seven districts and boroughs, he found that since 1872 they had examined over 10,000 samples of food; out of those 10,000 they had had occasion to bring a certificate into court over 1000 times, and in every case, except one, that certificate had been supported. That was a practical answer to one of the speakers yesterday, who, having announced himself as an analyst to a Defence Association, stated that it was all very well to quote the published reports of the Local Government Board, that those were only the reports of the analysts; but if they were taken into court before an independent tribunal, as he had said, out of twenty cases in which he had advised a defence, nineteen were successfully defended. Unfortunately, the exception in that case only proved the rule, but he would defer dealing with that point until afterwards, when he would show why those nineteen had failed. It was not long ago since he happened to be speaking to a very eminent foreign man of science, who told him he was astonished, seeing how many public analysts there were in England, how they went on year after year making so few mistakes.

No one was infallible, all make mistakes; but the mistakes made by public analysts were wonderfully few considering the enormous number of samples which passed through their hands. With regard to the Act of the present time, he found that in 1872, taking two of his districts, Lambeth and Wandsworth, in Wandsworth they prosecuted 25 per cent. of cases showing a large amount of adulteration, for he did not mean only adulteration on the analysts' report, but adulteration proved to exist by convictions. In Lambeth also there was the same proportion; last year the percentage in Wandsworth had come down to 6½, and in Lambeth to 12. This was a direct proof of the benefit of the Act.

In Wandsworth especially, the Act was carried out in a most intelligent and excellent manner. One man was set apart whose whole duty was to perambulate the parish, and try to get hold of bad articles, but he could only find 6 per cent. But ought they to be satisfied with the Act as it now stood? He thought not; there was no reason why what was done in one parish should not be done in another. Still, limiting himself to his own experience, he found that in one district, where the inspection was very complete, and the number of samples taken annually was never less than 400, the percentage of adulteration had been reduced from 25 to 6½; in the next district, where the inspection was not quite so complete, where only 300 samples were taken, it had only been reduced from 25 to 12; and going again to another district, where the inspection was very incomplete, and where probably he did not get more than 20 or 30 samples in the year, he found every one of them bad. Then he came at last to two districts, one of them, that of Newington, where the Act had never been put in force at all. What the state of matters was there he had no means of saying, as it was not his business to go and collect samples; but he thought if some of the newspaper editors would undertake to make an examination of those districts, rather an astonishing revelation would be made. What, then, were the points on which the Act required amendment? In the first place, there ought to be a compulsory appointment of inspectors. The Local Government Board could make it compulsory on a Local Board to appoint an analyst, but as they were not bound to appoint an inspector, the analyst would have nothing to examine. Inspectors also ought be appointed compulsorily, and it ought to be compulsory that the number of samples purchased for examination in the course of the year should bear some reasonable ratio to the number of dealers within the district. It might be too much to expect, but he certainly thought every dealer ought to be visited at least once a year, so as to see who were honest men and who were not; particular dealers ought not to be singled out, but a regular system ought to be adopted, and one sample, at least, taken from every dealer. If he understood Dr. Bell rightly as far as he expressed an opinion, it was not desirable to have too many limits and standards, but his opinion was that the true reform required was that the Act should be assimilated in many respects to the New Zealand Sale of Food and Drugs Act, and that there should be certain limits fixed, below which articles should be deemed adulterated. This point came very prominently forward in the case of milk, with regard to which Dr. Bell seemed to think that if such a course were adopted it would restrict the out-put. He did not think it would have that result, and it seemed to him that where you had a variable article like milk, the lowest possible honest milk should be the limit below which the dealer should not go, though he might go as much above it as he liked.

It would leave every man perfectly free to take his own view of his own business, and the man who sold the best milk would get the most business. Why should a reasonably low limit restrict the trade at all? In order to arrive at a limit, there should be a permanent Commission appointed, consisting of one eminent chemist appointed by the Government, such as Dr. Bell, another appointed by the Public Analysts, and a third who should represent the Chamber of Trade. It should be the duty of the Commission to examine in turn every commercial article of food, and to lay down a limit, beneath which that article should not sink, and when that Commission made its report, an Order in Council should be sufficient to give effect to the standard. That would put an end to all heart-burnings, because the traders themselves having a voice in the Commission, as well as scientific men, every one would feel that the matter was fairly dealt with. This was not a chimerical scheme, for it was already adopted in New Zealand, and during last year the schedules of standards had been commenced which would be added to from time to time on the recommendation of the Commission of Experts. With regard to the question of milk generally, he had rather radical views, and he thought the great mistake made by everybody, including analysts was, that they had been too anxious to draw a hard and fast limit, based on one particular quality of milk, when it seemed to him there ought to be a sliding scale. Supposing they adopted the figure of 9 per cent. solids not fat, as the standard, it had been his experience, extending over some 6,000 analyses of milk, that wherever the solids not fat were very low, there was invariably an increase of fat in the milk, and he, from the first, had made it a practice never to condemn the milk where the solids not fat fell to 8·3, or 8·5, if that milk had an excess of cream, because he found that when you lowered the one you gained in the other. Therefore, he thought the standard should be so fixed that if the fat were over a certain limit, it would not matter if the solids not fat were rather lower. On the other hand, if the fat were below a certain limit, plainly showing that skimming had taken place, then the solids not fat ought to be calculated on a higher standard, because taking away the fat from the milk by skimming increased the proportion of solids not fat. He hoped that before many years a Commission would be appointed which would have the power to make these standards, and that a sliding scale in this case would be adopted.

He had been asked by some of his colleagues to refer briefly to some remarks made yesterday. In the first place, Dr. Voelcker, for whom they all had a great esteem, made rather an unfortunate slip in giving what he called some advice to public analysts, which was not to be too hasty in jumping to conclusions. It was certainly very good advice, and he did not object to any one advising him, but the question arose, Did they require that advice, and was Dr. Voelcker entitled to give it? That gentleman, to show some ground for the advice he gave, mentioned a certain case in which a sample of cream contained starch, which on investigation he ascertained to have arisen from its being strained through a new cloth. But then this difficulty arose : if Dr. Voelcker had been in the position of a public analyst, and the cream had been brought to him by an inspector, he would not know where it came from, and would have no opportunity of making inquiries about the cloth or anything else. He was bound by the law to state either that the cream was pure, or that it had something in it. What was the analyst to do but to state that the cream did contain starch, and leave it to the other party to explain how the starch got there. Then Professor Attfield had spoken to twenty prosecutions, nineteen of which failed, and the inference would naturally be that in those cases adulteration did not exist at all. He would give one or two cases in point to explain the matter. There was a public analyst who had to examine some scammony—rather an expensive drug—in which he found chalk, and it effervesced in hydrochloric acid. The analyst, referring to the notes about scammony in the Pharmacopœia, found it specially mentioned that it ought not to effervesce in hydrochloric acid. At all events, he felt bound to give a certificate that that scammony did contain chalk. Then the case came into court, and the Defence Association and Professor Attfield came forward and explained that that chalk must not be taken notice of at all, it was not an adulteration, and that the scammony-root grew in a chalky soil, that the gum was obtained by making little incisions in the root and by putting in little shells in which it collected, and what was more natural than for the innocent natives to put a little chalk upon it to keep the scammony from sticking to the shell. Of course the analyst was laughed out of court, and the chalk was pronounced to be not an adulteration but a mere accident. But that did not show the analyst was wrong. He was bound to say exactly what he found there, or else say the article was pure, which in that case he could not. He could not go into an explanation of this story about the niggers and the chalk, which the defendant could and did so successfully. All these nineteen prosecutions were of a similar nature. To take another instance, an analyst had brought to him an article which was called milk of sulphur, and on analysis he found it contained so much sulphur and so much sulphate of lime, and the authorities took the case into court. He should remark here that the analyst had nothing to do with taking the cases into court; he simply said what the article contained, and it was for the authorities to decide whether proceedings should be taken. When this case came into court, the other side came forward and showed that it was quite a common thing to put sulphate of lime with sulphur; that in fact the public liked sulphur mixed with sulphate of lime, and that for some complaints it was far better, and in point of fact it was quite a legal thing to sell. He was not going to dispute the decision that it was legal, but it was not anything against the analyst, whose report was not in any way impugned. Both in that case and in the case of the scammony the decision did not affect the analyst. It was a mere settlement of the legal question, whether scammony should naturally contain chalk, and whether sulphur should naturally contain sulphate of lime. It was settled that they should, and those were things that had to be brought before the Court to settle, for there was no other way of settling them. Another case was referred to by Dr. Voelcker, in which milk threw up a purple cream, and on examination he found it contained aniline. Of course, not being a public analyst, he did not jump to a conclusion, but made inquiries, and found the milk had been filtered through a red cloth. He assumed that, had he been a public analyst, he would have jumped to a conclusion.

What else could he have done? He could not have said the cream was pure, and must have stated that it contained aniline. It was not his province to inquire how the aniline got there. After this explanation he hoped that the position of public analysts would be more fairly understood in future.

The following communication was then read by the Secretary from Mr. Bannister, of the Chemical Department, Somerset House, who was unable to be present :—

Dr. Dupré, and other public analysts who spoke yesterday, attempted to draw a great distinction between the standard or limit of the public analysts, viz., 9·0 for solids not fat, and 2·5 of fat, and that of Somerset House. In this statement the fact is altogether overlooked, that the methods of analysis are different, and therefore the results are not concordant. The method of obtaining the amount of solids not fat laid down by the public analysts is to dry the solids not fat for three hours only, and not continue to dry till the weight is constant. In our laboratory the "solids not fat" and "fat" also are dried till the weight is constant, and from experience we know that 9·0 per cent. of solids not fat, as determined by the method followed by the public analysts, is only equal to about 8·5 per cent. when dried to a constant weight. Many of the analysts are alive to the unsatisfactory results obtained by the Society's method, and Mr. Hehner, who spoke yesterday, says of it ('The Analyst,' vol. vii. No. 73, April, 1882) :—

"It appears to me that as much more concordant results are obtained when the solids are dried to constant weight than for three hours only, it would be well to discard the old plan, and accordingly to lower the limits of 'solids not fat' from 9·0 to 8·5 per cent."

It is therefore not a matter of difference of standards, but of the methods of working, and it is unfair to try to lead the public to believe that we have lowered the standard for milk simply, because we work in a way which gives constant results. We gave the three hours' drying method a fair trial, but as it was not reliable we abandoned it many years ago for the one we now employ.

With regard to the admission that milk varies in composition, it is pleasant to know that this fact is now conceded, for I remember very well when many analysts held that milk did not vary in composition, but only in the quantity given by different cows, and that it was childish to suppose that any cow could give milk containing less than 9 per cent. of solids not fat.

In construing the Food and Drugs Act, we must bear in mind what was the deliberate intention of the Legislature in placing it on the Statute Book, and this intention is well expressed in the report of the Select Committee of 1874 in the following words :—

"Too high and rigid a standard has been fixed by some analysts, and no sufficient allowances have been made for natural variations in milk. Ten per cent. of milk solids may be more difficult to obtain under certain unfavourable conditions than 12 or 14 per cent. under a more generous diet, a warmer atmosphere, and a comfortable lodging. . . . Allowances should therefore be made for these natural variations, which some purely scientific chemists seem to have occasionally overlooked."

It is evident from this quotation that the Legislature could not agree with the views of the analysts, and it is equally evident to me that if more stringent regulations are to be enforced, we must get further powers in a new Adulteration Act.

The following communication was then read from Dr. Wallace, of Glasgow :—

With regard to the question of the possibility of having a standard for milk, I think it would do very well to have a standard not too low, say, 8·5 solids not fat, and 2·5 of fat, or 8·75 and 2·75 respectively, and that in any case when the quantities came below these standards, the milkman should have the privilege of proving his innocence by having the cow or cows milked in presence of the inspector or the analyst. In the case of a man having, say, a dozen cows, it should be no defence for him to show that one of his cows gives milk of unusually low quality.

In any future Act it should be made compulsory for all towns and local authorities to appoint both analysts and inspectors, and the analyst should be paid not by fees, but by a fixed salary, at the rate of *not less* than £1 for every 1000 inhabitants; and the inspector should be obliged to supply to the analyst *not fewer* than one sample per annum for every 500 inhabitants.

There should also be a provision for employing, under the instructions of the inspector, working people, in their everyday apparel, to take samples, as it is useless to attempt to get correct samples by employing ordinary inspectors, who are frequently police sergeants, and who, at all events, are well known to the dairymen and shopkeepers.

Mr. GEO. BARHAM said they had been all much instructed by Dr. Bell's able Paper; a discussion on the adulteration of food was very important, and it was pleasant to see so many public analysts taking part in it, but he must express his regret to see so few of the other side present. What was wanted at such Conferences was not to hear one man's ideas, or one set of men's theories, but to endeavour as far as possible to insure the supply of pure food to the public. Instead of public analysts setting themselves apart from traders, and looking upon them as their natural enemies, and speaking in a sneering tone of commercial morality, he thought it would be better if they occasionally called in the leaders of the various trades to aid them in carrying these Acts into operation. Having given evidence in the year 1884 before a Committee of the House of Commons, which inquired into the working of the adulteration Act of 1872, and representing 300 dairy farmers, and being deputed by the Metropolitan Dairymen's Society to be present at this meeting, he thought he was entitled to say a few words. He had the greatest respect for public analysts, but as there were dairymen and dairymen, so there were public analysts and public analysts, and those gentlemen who were members of the society knew very much better where to draw the distinction than he did. Professor de Chaumont had spoken on the previous day about commercial morality, and said they could never stop adulteration until the scale of morality was higher, and that was no doubt correct. Why should a dairyman be asked to supply milk without water, when he had to buy beer with 50 per cent. of water, to buy bread with a certain proportion of alum ; as to drugs, he was not quite sure about them, and even taking professional men, like lawyers, did they not skim their milk ; did they not set it for years and skim it every two or three months, or as often as they could get a cheque. If he went to a horse repository to buy a horse, did he find honesty there ? and it was said that cattle jobbers were even worse than horse dealers. If he bought a piece of furniture he was assured that it was solid mahogany when it was only veneered ; or if he went into a linendraper's to buy flannel or cloth, and purchased what was warranted to be all wool, it would probably be found to contain more or less cotton. What protection had he in all these cases ; and why should dairymen, therefore, be expected to be the only honest people in the world. Of course they ought all to be honest, but they ought not to be attacked as if there were none honest among them. Dr. Voelcker had spoken of cream being extracted in the strawberry season, but he should like him to be apprenticed to the trade for a few weeks, and he was quite sure he would be satisfied that in such a season it was quite impossible to take off the cream and sell the remainder after standing for twelve or twenty-four hours as fresh milk. With regard to the use of boracic acid and bi-sulphite of lime, and so on, in his opinion they should be forbidden. As one of the public, he had no right to have his children dosed with boracic acid day after day for the purpose of enabling the dealer to save his milk ; and if he bought beer he did not want bi-sulphite of lime. All such preparations should be forbidden ; no doubt it would entail a certain amount of waste, but the public must pay for it, and they had better do that and have the article pure. He had no desire to be personal, but if he were inclined to be so, he should take exception to a public analyst occupying a very high position, writing sensational articles in the paper with reference to milk which had been purchased by his own officials, and then writing a letter to be advertised in the public prints, to one dairy firm two or three days afterwards, saying that the milk supplied by the said firm was perfectly pure. He thought that was highly objectionable, and he wondered that the Society of Public Analysts had not a certain amount of *esprit de corps* and professional pride which should prevent such things being done. Dr. Dupré spoke with reference to the adulteration of milk, and the quality he found on Sunday mornings and other days, but it seemed to him that he had named his own remedy, he had only to send every other Sunday for samples, and the milk would always be pure. Then Mr. Hehner said the Adulteration Act had worked great benefit, for whereas milk used to be adulterated with 50 per cent. of water, they now rarely found 20 per cent., and in the majority of cases it was only 10 per cent. He was pleased to hear it, and he believed it was perfectly true ; but what did Mr. Wigner say ? that within the last four or five years the percentage had increased, and if that were the case the only inference to be drawn was, that the analysts and inspectors and all this great expense was of no earthly use. Another gentleman referred to the Paris supply, and he had often noticed that Englishmen disparaged themselves more than any one else, and always thought that things were done very much better abroad. For instance, he once heard the secretary of the Royal Agricultural Society say he would not drink a drop of English milk, and would not allow a pound of English butter to come into his house—a most extraordinary statement for such a man to make—because he found everything was done so much better abroad. Why was that ? It was simply because he had gone abroad as secretary of the Royal Agricultural Society ; he had been taken to show places, and everything had been made nice and smooth for him, the same as we should do here if the secretary of some great society abroad should come, sending a letter beforehand to say when he was to be expected. He had made the supply of milk to Paris a particular study, and had seen the whole process from beginning to end. In the first place, the morning milk was boiled, it was cooked milk, the night's milk was put with it, a thing unheard of amongst dairymen in England, and those two milks mixed together were sent in to Paris next morning. They only had a supply once a day, and on a hot summer's day it was impossible to get a drop of sweet milk at one o'clock in Paris. He had tried to do so, saying it was wanted for a sick child, but he could not get it; he was told they had a little milk just on the turn, which would be all right with a teaspoonful of bicarbonate of soda stirred up with it, but that was the best he could obtain. There was no town in the world supplied with better milk than London. He must say he was very much pleased with Dr. Muter's careful speech; he said he would have no water put into milk, and there he agreed with him; but this was his difficult point, which he could not reconcile his commercial morality to: the analyst went into Court and swore that a given sample contained added water. Now, had he found the added water? No, he knew he had not; he had found a certain amount of solids, and if he were to go into Court and say that he had only found a certain amount of solids, and inferred that there must be added water, the case would be dismissed. He acted entirely by the amount of fat, and no fatty solids, and he went deliberately and told the magistrate and signed the certificate that he found a certain amount of added water, and in the result the dairyman was convicted of fraud. It was said that eels got used to being skinned, and some people seemed to think that dairymen paid the fines with a great amount of pleasure. But there were dairymen who would scorn to be convicted of fraudulently deceiving the public. Professor de Chaumont, speaking of commercial morality, said these men would scorn to put their hands into his pocket and take out *6d.*, but they would not hesitate to defraud him by adulterating his goods, which in reality was the same thing. You were convicting that man of picking another man's pocket—in fact, of robbery, for there was no other term for it. As to paying the fine, it was comparatively nothing. As Shakespeare said :—

> " Who steals my purse steals trash ;
> But he that filches from me my good name,
> Robs me of that which not enriches him,
> And makes me poor indeed."

And many traders were under the same impression. When this Act was first passed, the Society he represented invited the public analysts to meet them with the view of fixing standards, but that was declined. What they wanted analysts to do was to give them a ready means of detecting added water. He did not mean water digested by the cow, but raw water added, and if they could do that he would guarantee it would do more to stop adulteration than all the fines in the world. With regard to the standard, a cow had been called a machine for making milk, and so she was, but unfortunately they could not control her like a steam engine, and though you gave a cow good food, she might take it into her head to produce a large amount of fatty solids, and a small proportion of non-fatty solids, and if they sold that to the public they might be convicted of selling watered milk. 9 per cent. was adopted as the standard for non-fatty solids, and at that point the public analysts did not give a certificate that the milk was adulterated, but if it should only come up to 8·5, 8·6, or 8·7, did they say that the difference between 8·7 and 9 represented the amount of adulteration ? No ! They raised the standard then to 9·3. Was that just and right ? Were they not deceiving the magistrates, the public, and everybody else, if it were so ? Now, with regard to this standard, he would quote a few figures. There was a dairy show held annually in London, and one of the most useful classes was the class for milking cows, in which the prize was given for the animal which gave the most milk of the richest quality. It was the duty of every exhibitor to feed his cows as well as he could, and to get the very highest quality of milk. The figures he was going to read would be found in the report of the British Dairy Farmers' Association, the samples being taken in the presence of four or five judges, and analysed by Dr. Voelcker. The following were the figures of the milk of some of the short-horn cows :—

Non-fatty solids ..	8·5	Fatty	4·1
” ” ..	8·8	”	3·7
” ” ..	8·4	”	4
” ” ..	8·8	”	4·7
” ” ..	8·8	”	3·1
” ” ..	7·8	”	3·9

Was it to be said that these animals were to be sent to the butcher as being unfit to produce milk? Out of 23 short-horn cows 12 gave less than 9 per cent. of solids not fat, the average being 8·9, and 3·7 of fat. Taking Jerseys and Guernseys, which gave the richest milk in the world, one gave 8·8, another 8·5, and another 8. Again, taking the Dutch cows, the average of total solids was 11·8, the fat being nearly 3, so that the average of the whole of the cows was less than 9. Were all these animals to be sent to the slaughterhouse? He could tell them how they could be sure of having pure milk, and that was to make up their minds never to pay less than 5*d.* a quart for it; dairymen would then get a fair profit, would be afraid to lose their custom, and would always supply pure milk. If they were working like brewers and did as Dr. Richardson said they ought to, for he contended that drawing milk from a cow was a barbarism, that the component parts ought to be mixed together without the trouble of going to the cow for it, and when they could prepare milk like that, then would be the time to fix a standard. You could not go to a butcher's shop and always find the meat containing the same quantity of fatty and non-fatty solids. If a standard were fixed, it must be low enough to cover the poorer samples, and then people would have to depend on the repute of the firm with which they traded. With regard to the butter-fats, that was a most difficult thing. There ought to be 3 per cent., but if that was always insisted upon, any dairyman might be fined or punished. An alteration was constantly going on in milk; if it were set in a can at night, by the next morning the cream would be at the top, and the heavier portion at the bottom, and that change went on not only in the dairyman's shop, but in the cow's udder. Some Sunday morning, when the inspector went to get samples, the dairyman's man might have overslept himself, and instead of finishing milking the cows would scamp them, the consequence of which would be that there might be only 2 per cent. of fat in the milk. Then, again, milk which came 150 miles, as some of it did, might be partially churned ; he had seen globules of fat floating on the surface, which would take off ½ of 1 per cent. of the fat. Then, again, the milk stood in the cans in the shop, and samples taken later in the day would not be so good as those taken earlier. With regard to altering the Act, he should certainly like to see it altered. Dairymen were not an influential body of men, but some two or three years ago they did go to Parliament and got the Act altered to a slight extent ; there was a little Act brought in, saying that milk should be sampled at the railway stations, because unless the sources of any article were kept pure it was impossible to have it distributed pure, and in some cases it was alleged that the milk was sent up from the country in an adulterated state. The Act was therefore altered, giving power to the inspectors to obtain samples at the railway stations, but perhaps some gentlemen present could tell him at how many stations this was carried out.

Dr. MUTER said it was carried out in Lambeth and Wandsworth.

Mr. BARHAM said it was carried out in St. Pancras and Paddington and the districts named by Dr. Muter, but he believed in no others in London, although the proper authorities had been asked to do so. Then, again, Clause 14 said, the inspector, when purchasing a sample should offer to divide it into three parts. Now those words, "shall offer," ought to be taken out, and it should be compulsory on the inspector to divide the sample. Another point was with regard to the written warranties ; these traders were told they should buy their goods with a written warranty; they were probably aware that a dairyman purchased his milk twice a day, and if he agreed with a farmer or a wholesale man to supply him with milk warranted pure for a twelvemonth at a given price, they would suppose that was a written warranty, but it was nothing of the kind. It had been decided that a dairyman must have a written warranty with every consignment, which of course was utterly impracticable. What farmer would get up at four o'clock in the morning to write a warranty to put on a can of milk? Then, again, the Act provided that in the certificate the analyst should say if the milk had undergone any change. He thought it would be better to provide that the summons should be issued within a week which would allow plenty of time for the analysis to be made, and if necessary the remainder of the sample could be tested while it was comparatively fresh. If the Act were to be carried out properly it should be made to people's interest to carry it out. There was more heartburning over one honest man convicted unjustly, and more prejudice excited against the Adulteration Act, than by 500 just convictions.

Dr. STEVENSON said he had no intention of replying to Mr. Barham, who represented a large and important interest, but he could not help feeling that if they could get at his own private opinion he would be inclined to fix a higher standard for milk than he had admitted in his speech. He was unwilling to fix any absolute standard, and was rather inclined to agree with Dr. Muter, that when milk was rich in cream, or butter-fat, some allowance might be made for solids not fat. At the same time, he must enter a protest against the adoption of any such standard as had been proposed by Dr. Voelcker. He was quite sure that although the milk supply in London was greatly improved, it was not what it should be, and if that standard were adopted they would have a depreciation of the quality of milk very likely to the extent of 10 or 12 per cent. Mr. Barham said that analysts swore that milk contained so much added water, but though he had signed some thousands of certificates under the Act, he was not aware that he had made any such declaration. The form of certificate was that the analyst expressed an *opinion* that there was so much added water. He wished to impress on the general public, a good many of whom he believed were present, that public analysts were desirous of having more assistance from them in carrying out the Act. It was quite astonishing the few samples which were sent to them in this way. In the case of public institutions especially, he had had from time to time to examine the drugs supplied to hospitals, infirmaries, and so on, and he had been astonished to find what inferior articles, as a rule, were supplied, compared with those supplied to the general public. It was, of course, said that the manufacturers contracted at a figure for which the articles could not be supplied, and possibly that was so in many instances; but still that did not exonerate the trader from promising to supply a genuine article at a price at which he knew it could not be legitimately sold, and then supplying an inferior article. It would be well if analysts directed their attention more to drugs, and he mentioned this because he noticed there were many gentlemen present connected with pharmacy. He had examined many articles supplied by pharmacists, and he could vouch for many of them, that they were supplied with a care and precision of quality which left nothing whatever to be desired; but, on the other hand, there were certain classes of traders supplying at a cheap rate to medical men and public institutions drugs of a very inferior class. To give an instance recently brought before him, though not officially, in a compound senna mixture he found that its virtues depended on the presence of an enormous excess of Epsom salts, which was a legitimate constituent; but the senna was conspicuous by its absence, and the very much cheaper sulphate of magnesia was substituted. He did not mean to speak disparagingly of pharmacists as a body, for he thought no class of the community, as a rule, supplied better articles, but there were many who did not. With regard to the question of articles of an inferior character being sophisticated by the addition of something which gave them a good appearance, such as the addition of alum to bread, he should have liked that point to have been discussed by those best competent to form an opinion how far it was legitimate to utilise inferior articles in this way. It was well known that there were certain classes of flours which were not what was called in a sound state, and out of which a good presentable loaf could not be made, yet by the addition of alum it could. He was of opinion that if you took an unsound flour and added alum to it, and made a presentable loaf, the purchaser had a more wholesome article than if no alum were added to the unsound flour; but that did not quite settle the question. If the purchaser were told that alum was mixed with the bread, it would be right enough, but he did not understand the morality of giving to this originally inferior article a better appearance, and making it more like a good article ; and this was only typical of several other things that were treated in the same way.

Mr. EASTON (who described himself as a dairyman and editor of a paper connected with the dairy trade) said dairymen had no antipathy whatever against analysts as individuals, but they had an antipathy to incapable analysts who were not quite fit for the position they occupied, and whose certificates had been the means of partially ruining many honest traders. The statement had been made, that out of a thousand cases taken into court, only one had been lost, but the question was how many of them had been contested. There were hundreds of cases where the defendants did not attempt any opposition. He knew a case where a man was fined for the addition of 4 per cent. of water, and he got the case adjourned, and sent the sample to Somerset House, and he was happy to say they gave a righteous decision, and the case was dismissed. One gentleman, who spoke yesterday, intimated that public analysts were better fitted to give an opinion than the chemists at Somerset House, because they analyse every year 6000 samples, whilst at Somerset House they did not perhaps analyse more than 600 altogether. But had the Public Analysts any evidence of the identity of the samples which they analysed, and if not how could they pronounce any of them adulterated. Did they obtain samples produced under all the different circumstances? or had they obtained them indiscriminately, and formed a general average? According to one gentleman, the adulteration of milk had dropped from 50 per cent. to 6 per cent., and the adulteration of articles of food had been going on from time immemorial. Now, as the Adulteration Act had only been in existence since 1872, it was quite within the range of possibility adulteration might become extinct, and then the occupation of the Public Analyst would be gone.

Mr. HELM (Somerset House) said Dr. Bell's paper was so cordially received that it was scarcely necessary for any one from the department over which he presided to address the meeting, were it not that in the course of the speeches a serious charge was made against him and his colleagues in their capacity of referees. Two gentlemen of position amongst public analysts had made the very serious charge that in adopting the standard they had at Somerset House they had taken as their standard either diseased or improperly fed cows. Now they could have no motive for doing so, and they had done nothing of the kind. They sought London round, and went as far north as Derbyshire, and as far west as Somerset, in order to get fair representative samples. Those two gentlemen said that the limits adopted by the Society of Public Analysts were 9 per cent. of solids not fat, and 2·5 per cent. of fat, but to-day he had been pleased to hear a past President of the Society say that he himself would pass a milk with 8 per cent. of solids not fat, provided the fat was fairly high; and yet because Somerset House adopted something like 8·5 or 8·4, they were told that their cows were diseased or badly fed. As Mr. Barham had said, it was not usual to exhibit badly fed or diseased cows at dairy shows. Dr. Dupré had on many occasions opposed the referees at Somerset House on account of their not adopting the limits laid down by the Society of Public Analysts, and said they were encouraging adulteration of milk by taking poorly fed and diseased cows as the standard; yesterday he was rather more moderate, for he said that occasionally a single cow might give less than 9 per cent., though whether such cows were diseased or improperly fed he was not prepared to say, but the mixed milk of a dairy was never so low. Now he happened to have with him the analyses referred to by Mr. Barham of the milk given by the cows exhibited at Islington. Those analyses were not made at Somerset House, but by a man of probably greater experience on this matter than any one in the country, namely, Dr. Voelcker, who found that in five years, from 1879 to 1883, out of twenty-three shorthorn cows thirteen gave a milk below the Society's standard; whilst out of nineteen Jerseys three gave milk below the standard; and out of sixteen Guernseys four gave milk below the standard; and out of six Dutch four were below the standard. Then it was said that the milk from a whole dairy would never give milk below the standard; but if the milk from the whole of the shorthorns exhibited had been mixed and tested, it would have been pronounced adulterated according to their standard. At Somerset House they sent round the whole of the country, and out of 238 single cows the milk of 184 would have been pronounced adulterated according to the Society's standard, being below nine. And out of twenty-four dairies eleven fell below the standard. What were they to think of Dr. Muter, who had passed a sample at 8 if the fat was high; and Dr. Stevenson congratulated him, and said he followed a somewhat similar course, while at the same time the referees, who did not belong to the Society, were to be opposed, because they had thought proper to act upon the results of their own investigation. There was nothing in Dr. Bell's paper which could give any offence to public analysts, but Dr. Dupré said how glad he was to have an opportunity of stating their grievances, one of which was, of course, that Somerset House had been the means of upsetting many of their certificates by not adopting their standard. He could assure him that the chemists at Somerset House were equally glad to have that opportunity of explaining their position, but the letter which had been read from Mr. Bannister had forestalled a great deal of what he had intended to say, The Society of Public Analysts adopted their standard on a basis suggested by Mr. Wanklyn, one point of which was to dry the milk for three hours only, then to take the fat out of it, and the difference was put to non-fatty solids. Now, of course, if any water were left in the milk, it would go to swell the non-fatty solids ; and in a paper which had been read by Mr. Hehner, he had shown that, by weighing the non-fatty solids dried, 8·5 was equivalent to something like 9, as usually estimated. How then could it be said that the cows must have been diseased or badly fed from which the Somerset House referees drew their figures, if 8·5 fully dried was equal to 9? And, as Dr. Bell had pointed out, it was far better in chemical analysis not to have any partial and comparative results, but to deal only with actual results, which any other chemist could deal with. He could assure all analysts present that there was no work done at Somerset House which gave so much anxiety as the reference samples, and they were always glad when their results agreed with those of the Public Analysts. The great question was what could be done to make the Act more effective. Unfortunately it was very inefficiently worked throughout the country. Theoretically the machinery provided was effective, but it was not carried out. Dr. Dupré had suggested that inspectors should be compulsorily appointed, and that a certain percentage of samples should be purchased ; and that no doubt would be very good. But what would be the use of appointing an inspector, and insisting on his making purchases, if he always went about in a policeman's uniform. He thought the Local Government Board should be empowered, where there was reason to think the Act was not properly carried out, to work it themselves in some way or other, which he would leave to others to devise, but he feared the Act never would be efficiently worked without some further pressure from head quarters.

Mr. ANGELL said this was the first opportunity the public analysts had had of speaking at such a meeting before men eminent in the chemical world, and before the representatives of what he might call the Upper House who were set over them. One of the earliest grievances of the public analysts was that they had certain gentlemen set over them in an upper chamber whom they could not approach. He was also glad to have come face to face with those who seemed to look upon public analysts as if they had something like the other side to play. One gentleman spoke of it as if it was a game with two sides, and seemed to think that two blacks made a white, by showing that many other people besides dairymen were to blame. He also seemed to have misunderstood some of the previous remarks, and to have mixed up a statement made by one gentleman, that the percentage of cases of milk adulteration had increased, with the statement of another, that the percentage of water had decreased. The two facts were, however, by no means inconsistent. He also said they could not tell added water from other water, and that was the same complaint he had heard made once before when lecturing before a body of farmers in Hampshire. He had taken some pains to show why it was reasonable to suppose that such a secretion as milk might be expected to be somewhat constant in its nature, and to show by experiments that that was really the case, as it was within certain limits. One of the farmers present then wanted to know whether he could tell added water from other water, and having admitted that he could not, he was told that he was no use, and he might sit down. He did not, of course, accuse Somerset House of having specially prepared cows, though one of the gentlemen seemed to intimate that they were, and if it were the case it might give rise to some difference in the results.

Mr. EASTON said what he meant to say was that at Somerset House they investigated the variations which occur in genuine milk under all circumstances.

Mr. ANGELL said one speaker had referred to the difficulty of deciding as to what might be passed as beer, and it frequently happened that the authorities in various districts took upon themselves, in a fit of indignation as to the quality of the beer in their neighbourhood, to send him a great many samples, and in consequence of the fact that there was no formula laid down for the composition of that beverage, he was bound, unless he found something absolutely injurious to health, to certify that the beer was genuine, which no doubt sometimes produced considerable astonishment. He thought he could see a way out of the difficulty. If the only alternative was to suppress that very large and very reasonable form of commerce which consisted in making up various kinds of tonic drinks and selling them under the name of beer, or to leave them alone, he should say leave them alone ; but he thought it might very reasonably be laid down, that if a man asked for a glass of beer he should have nothing but malt and hops, but in order to meet the difficulty of not suppressing a good wholesome article—not beer—it should be sold as ale. He would suggest that under the name of ale anything might be sold in the shape of bitter and wholesome beverage made from what source it might, but if a man asked for beer he should have malt and hops only supplied. As Professor Attfield was not present, he should not say as much in reply to him as he had intended, but he certainly thought such statements as he had made should be put forward with extreme caution, and he claimed for public analysts a much more independent position than Professor Attfield held with regard to any prosecutions he had been connected with. He had spoken of some 20 cases, and in two or three of these he appeared on one side and Professor Attfield on the other. Now, which of the two were to be considered the more interested parties, the gentleman who held a high reputation as a distinctly qualified man, the representative of a powerful trade union, which came down with its counsel and its legal pleaders, and chemical pleader in some cases, with a vast number of pharmacopœias piled up (and if one did not cover the case another did), or the public analyst? If the analyst ventured to say that the article was set down in the British Pharmacopœia and that it did not answer the tests there prescribed, then they did not believe in the pharmacopœia at all; but if, on the other hand, there was some other pharmacopœia which could be taken out from the British Museum which would answer their purpose, it was brought out and paraded, and if the case was dismissed, they were told they must look upon it as if an error had been detected. Of course there were such things as differences of opinion, but it was decidedly incorrect to speak of these cases in which prosecutions had been dismissed as if they arose from errors of the analyst. He had intended to have referred to several instances in which Professor Attfield was concerned, in one of which he actually found, where others could not, a very fine trace of soda carbonate in the presence of a considerable quantity of sulphate of lime in so-called soda water, by some extraordinary method which he had kept secret up to the present time, but as he was not present he would not go into details.

Professor REDWOOD said he had listened with considerable interest to the discussion which had taken place, but what had been said by several previous speakers had superseded the necessity of his saying much upon the subject. He almost entirely agreed with what had been said by Dr. Muter, and he might say also with reference to the very spirited remarks of Mr. Barham, that all who heard him must congratulate themselves on having heard a very able defence of the dairymen. But there were two points which had not been thoroughly disposed of, upon which he would make a few remarks. First, in reference to the statement made yesterday, that the Adulteration Act had not accomplished all that was expected from it, or even much that could be satisfactorily referred to, because it was found on reference to statistics that the proportion of adulterated articles continued very much what it was in the first instance. No doubt that argument would have weight with many persons unless some explanation were given of it. Now it appeared to him that that arose mainly from the circumstance that a very considerable change had taken place in the nature of the substances collected by the inspectors for analysis as compared with what was the case some years ago. He had been a public analyst almost from the commencement, and had had very considerable experience, and he should say that when this work commenced the inspectors were in the habit of collecting a very large number of samples of different kinds, but in process of time it was ascertained that a large number of these articles which they had been in the habit of collecting were found practically never to be adulterated, and latterly the inspectors had confined themselves to a limited number of articles, such as were most liable to adulteration—such, for instance, as milk, butter, coffee, mustard, and a few other articles—those, in fact, referred to by Dr. Bell as being the articles which were alone found to be to any general extent subject to adulteration. Seeing that the articles now collected were only those liable to adulteration, it would naturally follow that the proportion of adulterated specimens amongst them should be greater in relation to the aggregate than where a larger number of different classes of articles were examined. This was the principal cause of the continuance of the same percentage of adulteration as occurred some years ago. There were other causes certainly, amongst which might be named the imperfect manner in which the Act was carried out, for in those districts where it had been most regularly and systematically enforced, there had been a very considerable improvement. In one of the two Metropolitan districts with which he was connected, there had been a very large improvement in this respect; whereas in others the case was quite otherwise, those being districts where the inspectors only now and then purchased samples for analysis; the result of which was that certain traders got into the irregular habit of supplying adulterated articles. He should be glad to hear from Dr. Bell whether, when he referred to cocoa and mustard, he intended to indicate that he did not consider the addition of flour, starch, or sugar an adulteration. The view which he acted upon was this: he certainly considered the substance sold to the public under the name of cocoa was well understood, unless there were some special explanations given, to be cocoa mixed with starch and sugar, but, nevertheless, if he found a sample with an undue proportion of those additions, he should look upon it as an adulteration. The same with reference to mustard ; from the commencement he had considered that the addition of a little flour to mustard improved its quality, where it was used for dietetic purposes, but if he found more than 8 or 10 per cent. of starch, he should certainly also look upon that as an adulteration. Of course, if mustard were intended to be used for medical purposes, it should be in a state of purity ; but when only used for dietetic purposes, he did not consider that in those cases in which the starch was intentionally omitted it was really any better in quality than it would be if there were a certain portion of starch present in it.

Mr. CHESHIRE said he was very glad that he had taken the trouble to come from Hastings to attend the Conference which had been very interesting. It was stated that the percentage of adulteration was probably very much higher than the reports gave, on account of tradesmen often knowing the inspectors, especially when they were in uniform ; but he would draw attention to the fact that there was another side to that question, in his district certainly. There the inspector only procured samples when he had reason to suppose he should find them adulterated, and yet they found that only about 15 per cent. were adulterated. Means were taken by the inspector to prevent suspected persons knowing him, by sending other persons, or by asking for articles from special canisters, and he might say that in the case of about half-a-dozen samples which had been sent to him for analysis by private persons he had not found one adulterated. One reason why small fines were sometimes imposed was, that they did not always fall on the really guilty party ; the small dealer often bought from the wholesale man without a written warranty, in which case he had to suffer, and the plea was often made, in the Hastings

Court, that they had sold the articles as they bought them. With regard to the amount of adulteration, he had always made it a practice only to certify to such an amount as he could feel sure of, but if a very small amount only were stated, so as to be quite safe, sometimes the magistrate would remark upon it to the effect that there must be some mistake, for it could not be worth the while of the tradesman to run the risk of detection for such a small advantage. With regard to the necessity of giving quantities in the certificate, he was in favour of keeping things as they were. He thought an analyst ought to be bound to say something about quantity, for though it had been very fairly remarked that it was very difficult in some cases to give the quantity at all accurately, he for one always put the word "about" in, which was quite sufficient to cover any slight margin. Only recently he had a case in which he had certified that a sample of raspberry jam contained about 50 per cent. of apple jam; he believed it was really more, but that word "about" was never objected to. With regard to the improvement in the percentage, he might refer to another district, Rye, which was one of those places in which they went for three or four years without taking any samples, and then made a grand rush. He would have a letter from the Town Clerk, stating that some samples were going to be brought to him, and shortly he would have a number of samples of milk, one from each dealer, nearly half of which turned out to be adulterated. The Town Clerk also said that next week he was going to send him samples of butter, but he told him afterwards that he could hardly find any butter in Rye, that it was all butterine. That showed how much more careful tradesmen were when they knew the Act was going to be put into force. The Chairman had referred to the question of beer, and said there seemed to be no definition of it. Now, he took it, it must be a fermented liquor containing spirit and a wholesome bitter, and that was the definition he had gone by. As regards the use of chemical re-agents, he adopted the practice that if they had been used reasonably, and with good effect, he passed them, but he thought there ought to be some precise understanding about these things. If a chemical re-agent looked at all suspicious, and was in any way unhealthy, he should certify against it at once. With regard to milk, it appeared that a majority of the low standard milks were analysed by Dr. Voelcker, and he thought it was quite clear that he adopted some different plan for drying the solids to that generally followed. In his own case, he adopted the usual plan of drying for three hours, and in every case—except where the fats were high, when if the solids were a little low, it had been passed—if it fell below 9 he had certified against it, and he never had an appeal to Somerset House, which appeared to show that the milkmen, in those cases, admitted the adulteration. As regards any alteration in the Act, it was quite true the word "adulteration" was not mentioned, but in their reports they had to state that a certain number of samples were genuine, and a certain number adulterated. With regard to that, a question had been raised whether skimmed milk could be said to be adulterated, and he thought perhaps "sophisticated" would be a better word. He had intended to have made some remarks on what fell from Professor Attfield, but after what had been already said, it was not necessary.

Mr. LLOYD said he thought the great object of the Food and Drugs Act was to ensure health, and that the public analyst was required rather to protect the public from any ill-effects of their food than to ensure that it should come up to certain standards. That was the difficulty he found in coming to any conclusion as to standards, especially in regard to milk, because that had proved of all articles of food the one which was most likely to produce disease. If the very best milk had water added to it, you enormously increased the liability to disease. There was also, he understood, a large amount of condensed milk mixed with water being sold as milk, and, if there were one practice more than another likely to prove detrimental, that was it. The liability to disease from even minute quantities of water getting into milk had been very great, and therefore the danger would be much greater if condensed milk were to be made up to the strength of ordinary milk, and sold as such. If the milk were condensed with sugar, the analyst could detect it, but some condensed milk was made without sugar, and he did not exactly see how that was to be dealt with. It was said the Act was largely a failure, owing to inspectors not being able to obtain samples, but that was provided against by the public being enabled to take samples. The difficulty, however, arose owing to a fee of 10*s.* being required, because no one could be expected to buy a shilling's worth of food and pay 10*s.* in order to prove whether it was pure. It was the duty of the State to protect the public; how that was to be done he was not prepared to say, beyond suggesting that, where there was any suspicion aroused, the public should be invited to apply to the inspector. After all, the great thing was to educate the public more upon this question. You could not expect a poor man to pay 1*s.* 6*d.* for coffee without chicory in preference to paying 1*s.* for coffee with chicory; and until they could educate the public to see the effect of pure food, the Act would never receive that public support which, after all, it mostly needed. He did not think it necessary to extend the Act to agricultural substances. The reason why analysis of food should be made at the expense of the State was because the food cost comparatively little compared to the cost of the analysis. But that was not the case with cattle food, and if you included feeding cakes which the farmer bought in large quantities, and with regard to which he could afford to protect himself, and was assisted by Farmers' Clubs in doing so, he did not see where you could stop. If it held good for cattle food, why should it not hold good for the manure with which he grew his crops, and the principle would have to be extended to analysis of woollen cloth and everything else.

Dr. VEITCH said that almost all the speakers who had addressed the Conference had referred principally to the question of milk adulteration. It was a question deserving of the great attention paid to it, because milk was an article of food not only in daily use, but one on which the younger part of the population almost entirely depended. He had devoted the last eight years exclusively to analytical work in connection with milk and milk products, and in the laboratory which had been under his charge for the last four years some 50 to 60 samples of milk were analysed daily. That there were some difficulties in connection with milk analysis and milk adulteration he thought was sufficiently proved by the animated debates which ensued whenever the subject was made a matter of discussion. The variations in the natural composition and the alterations caused by the tendency of the fat in milk to separate in the form of cream made it difficult to ensure the supply to the general public of an article in no way tampered with, and at the same time not to do wrong to the honest dealer. The liability to speedy decomposition very often made it difficult to prove a suspected, and confirm an alleged adulteration. Bearing in mind the fact that milk naturally varied to a great extent, a prosecution for adulterated milk would be almost impossible unless some standard or better limit were fixed. The question of how the limit should be fixed was a difficult one, and in his opinion could not be solved satisfactorily as long as the milk of individual cows and dairy milk was treated in the same way. Milk of individual cows sometimes came down very low as far as composition was concerned, and he could see no reason why dealers should not be compelled to sell such a milk labelled accordingly, and a lower standard should be applied to it. Dairy milk, which was the milk of a number of cows mixed, was much more uniform in character, although it might vary a great deal. The special gravity of milk could easily be ascertained by means of a small lactometer, and if only every small milk dealer who had no other means of protecting himself, and every householder who liked to have pure milk for himself and his offspring, would use this instrument, a great deal of watered milk would be banished from the streets of London in the shortest time ; but as it was impossible to detect adulteration in every case by this means, there would still be a great deal of the work left to the analyst. Where to fix the limit was a question of analytical method ;

if the total solids were given, the fat and non-fatty solids compensated one another. If by one method the fat was exhausted to the last trace, the solids not fat would be proportionately low; if, on the other hand, a particular method left about $\frac{1}{2}$ per cent. of fat in the non-fatty solids, the latter would be so much increased. How much of fat and non-fatty solids one might be allowed to expect in milk must be found out by statistical investigation, and he thought there existed plenty of material nowadays to settle the question at once. If out of 100 farmers 99 were able to produce milk of a certain standard, the 100th should be able to do the same, and if he fed his cows so poorly, or watered the milk through the cow, his milk should be excluded from the market. In his opinion, the standard applied by the Society of Public Analysts at present was quite fair and just to both parties. The tendency of the fat to rise in the form of cream must not be lost sight of, and he thought it was only right in the case of milk falling below the fixed limit, it should not be returned as watered or skimmed, but as not of the nature, quality, and substance of the article demanded, and public analysts should not be obliged to make statements which they could not prove, viz., that the addition or depreciation extended to such and such a percentage. As to decisions in the cases of disputed analyses, he thought it utterly impossible to put an analysis of an old and decomposed sample of milk against one made of the milk while it was sweet. As soon as decomposition had proceeded to a certain point, in his opinion, it was almost waste of time to analyse it.

Dr. BELL, in reply, said it was very satisfactory to find that hardly any exception had been taken to the contents of his Paper, and very few criticisms had been passed upon it. Dr. Dupré rather questioned the potency of fusel oil in whisky, but he still adhered to the statement he had made, and thought experience bore him out. It was a very common saying in Scotland, "You will not find a headache in a hogshead of that whisky," the reason being it was a matured and mellowed whisky, the fusel oil having been entirely changed into harmless compounds. Distillers might entirely dispense with all the trouble and expense of maturing spirits in bond if it were not for the deleterious character of the fusel oil present in new whisky. With regard to the question of cocoa and mustard, put by Dr. Redwood, he had stated, "That the only substances now found in cocoa were sugar and starch, and in mustard flour and turmeric, and these additions are not considered as adulterants so long as the preparations are not sold as pure or unmixed articles." It was not his province to decide what quantity should be present in cocoa or mustard to constitute adulteration; that was for the Justices, but if he found a greater quantity of flour in either article than is usually present in ordinary commercial samples, he should feel it his duty if that question formed part of the reference, to indicate that fact in his certificate. The great bone of contention throughout the discussion had been "milk;" and their position at Somerset House seemed to have been largely misunderstood with respect to that article; and he was glad to have this opportunity of explaining it. In the paper written by Mr. Bannister a paragraph was quoted from the report made by a Parliamentary Committee in 1874, which stated that cows yielded milk of different qualities; and indicating that proper allowances should be made for variations in quality. Parliament was aware of that, and laid down no limits of quality, and fixed no standard, but imposed on the Public Analysts and the Reference Department the duty of saying what was watered and what was not, and this was a serious responsibility in the face of the now admitted fact that milk does vary greatly in composition. Mr. Hehner said that when samples were sent to Somerset House, we often said we could not confirm the analyst's statement that water had been added. That was undoubtedly true, but as a matter of fact the public analyst was exactly in the same position, and the well known principle of English Law was that if there were any doubt in a case, the defendant should have the benefit of it ; therefore, if they could not say that water had been added, although they could not say it had not, they gave the defendant the benefit of the doubt. That, he believed, was the clear intention of Parliament in imposing those important duties upon them. He did not oppose the fixing of standards, or limits, but it was for the public analysts and the trade to arrange as to standards of quality, and not for him to do so ; his duty was simply to do justice between two parties. He had no objection to any standard of quality being laid down, provided it was laid down legally, but he could not lay it down, nor could the public analyst. With regard to the variations in the composition of milk, he was pleased to hear Dr. Muter state so honestly and fairly his views on the subject, and he hoped other analysts would follow in the same line, for it was the first time that any public analyst had publicly stated so clearly the truth of the matter. He did not say they were prepared to pronounce milk containing 8·6 or 8·7 of solids not fat not adulterated ; if they found evidence sufficient to satisfy their minds from other data connected with the analysis that it was adulterated ; but if they had not sufficient evidence from the data obtained, they could not conscientiously pronounce it adulterated, and they gave the defendant the benefit of the doubt. He was not prepared to go down to a very low limit, but was much disposed to agree largely with Dr. Wallace's suggestion, that if the milk went below a certain point, the seller should be called upon for an explanation, and if he could not satisfy the local authorities that his milk was genuine, then he should be called upon to satisfy the Justices. He thought that was the fair and proper way in which the Act should be applied to an article like milk. The desire of all should be to avoid inflicting any injury on honest tradesmen, for, as Mr. Barham had pointed out, it was a most serious thing for a tradesman to be fined for adulterating an article if he were innocent. With regard to the last speaker's remarks on the subject of the analysis of sour milk, it will, in his opinion, suffice for him to say that he entertains entirely different views on the matter. In conclusion, he begged to propose a vote of thanks to the Chairman for the very able and fair way in which he had conducted the Conference.

Dr. MUTER seconded the resolution, which was carried unanimously.

The CHAIRMAN said he thought they must make it a joint concern, and congratulate one another on having had a very good discussion. He only hoped that from the various opinions put forth by the public analysts on the one side, and by the representatives of Somerset House on the other, there would result a greater concensus of opinion and more good feeling one towards the other.

APPENDIX.

LACTIC ACID AND THE LACTATES AS FOOD PRODUCTS.

By Prof. William Ripley Nichols,

of Boston, Mass., U.S.A.

In asking your attention for a few moments to the manufacture of lactic acid and of the lactates on the large scale, I desire to say that I am not personally interested in a pecuniary way either in the manufacture or sale of these products. The application of the process which I have to describe was due to a friend of mine, Mr. Charles E. Avery, of Boston, and when the matter was brought to the attention of certain capitalists I was requested to examine and report upon the process, which is, certainly, of considerable interest to the chemist, and to the sanitarian as well.

When milk becomes sour, spontaneously as we say, the sourness is due to the presence of *lactic acid*, which was first extracted from sour milk by Scheele in 1780. The sugar of the milk has undergone a chemical change, as a result of which this acid has been formed. It is not alone from milk, however, that lactic acid may be obtained, for the fermentation of many vegetable substances gives rise to the formation of the same acid; thus, it is found in sauerkraut, in the fermented juice of the beet, and may be produced from almost any saccharine or amylaceous substance. When we say that milk becomes sour spontaneously, we speak from a microscopic standpoint: if we examine the matter microscopically, we find that the change is accompanied by the appearance and development of a multitude of minute organisms belonging to that order of beings which we speak of collectively as *bacteria*. The organisms which bring about this peculiar change we speak of as the lactic ferment.

Lactic acid is no new substance, and certain lactates,—as the lactate of soda, the lactate of lime, the lactate of zinc, &c.—have been prepared on the small scale and have been used to some extent in medicine. The method hitherto employed for the production of these substances has been one giving rise to the extremely offensive odours which accompany the decay of a mixed mass of animal and vegetable substances. In fact, the operation was hardly fit to be carried out in any ordinary laboratory. In the new process the material employed is clean Indian meal, that is, the meal obtained by grinding Indian corn, or maize, and, if the process be properly conducted, the only odour which is perceived is agreeable rather than otherwise. I will attempt to describe the process briefly.

The first point is the preparation of the ferment. The minute details of the procedure being of the nature of a trade secret. I am not myself familiar with them: in principle, however, it consists in the application of the method of cultivation which has proved so fruitful in the hands of the eminent specialist, M. Pasteur. As we know, the air about us contains the germs of many different sorts of organisms, among them those which, if they fall into proper liquids, are capable of bringing about the lactic fermentation. These are not, however, the only organisms which would fall into a vessel of milk if it were exposed to the air. The alcoholic, the acetic, the butyric ferments, or their germs, are present as well, and will also bring about their respective fermentations under favourable circumstances. The principle of the method now under consideration consists in the cultivation of the lactic ferment to the exclusion of all other sorts by arranging the temperature and other surrounding conditions so as to be most favourable to the growth of the peculiar organism which is able to change sugar and starch into lactic acid. These organisms multiply to the exclusion of other forms: then a quantity of milk or starch is fermented in the presence of ground chalk, which neutralises the acid as it is formed, and produces the neutral lactate of lime, the whole mixture becoming a solid mass of crystals. This mass of neutral lactate of lime, containing the organisms which give rise to this peculiar fermentation, is what is known technically in the manufactory as the "ferment."

Thus much with reference to the preparation of the "ferment:" the actual process of manufacture is as follows: Large wooden vats are employed, and into each is put one ton of meal, two tons of water, and half a ton of bolted whiting. Then a barrel of "ferment" resulting from a previous operation is added, and the whole well mixed together. In about eight hours the temperature of the mass has risen to 48° Centigrade. A block tin foil, through which cold water circulates, is then inserted in the vat, and allowed to remain for from 12 to 15 hours, the temperature being carefully maintained at 47° C. This is an important point in the process, because, if the temperature falls below 40° C. the fermentation ceases, while if it rises to 52° the ferment is killed. At the temperature of 47° C. fermentation goes on rapidly, torrents of carbonic acid gas are evolved, and the whole mass seems to be in most active ebullition. This evolution of carbonic acid is most rapid from the sixth to the fifteenth hour; at this point the cooler is usually removed, as thereafter the chemical action becomes less violent and maintains the temperature at the right point. After about four days, as a rule, and without further treatment, the whole mass becomes solid owing to the formation of crystals of the neutral lactate of lime, but the action goes on slowly for a day or two longer. I will not trouble you with details as to the purification of the crystals, as to the drying of the products, and as to other manufacturing details, which involve nothing which is essentially new in principle. By treating the neutral lactate of lime with just enough sulphuric acid, the lime is converted into sulphate of lime and the lactic acid set free; the sulphate of lime is removed by filtration, and the lactic acid evaporated in the vacuum pan until it reaches the required degree of concentration. If only one half of the requisite quantity of sulphuric acid is added, there is formed the bilactate or acid lactate of lime, which is, to be sure, not a perfectly definite compound; but this compound and the lactic acid of various grades are the principal commercial products.

The next question is, to what uses are these products put? The answer, in a general way is, that it is intended to offer them as substitutes for other more expensive substances already in use in the arts and in the household. The acid lactate of lime can replace the more expensive cream of tartar as a mordant in dyeing, and the acid itself is capable of useful application; but it is principally in connexion with articles of food that we have to consider these products. The most important use—at least in the United States—is in raising bread. In the States baking-powders are used to an enormous extent in making bread. In many parts of the country rolls—or *biscuits*, as we call them—prepared in this way are eaten morning and evening hot and fresh from the oven. It was at first proposed to mix the acid lactate of lime and the bicarbonate of soda in proper proportions, and sell the mixture as a baking-powder; but this has proved impracticable since, owing to the deliquescent character of the neutral lactate of lime, such a mixture gradually undergoes decomposition, and becomes useless for the intended purpose. The two powders are therefore supplied separately, with directions as to the proper proportions. A strong solution of lactic acid, containing 40 per cent. of the real acid, is also put upon the market to be used for the same purpose, three tea-spoonfuls of the acid and one tea-spoonful of soda being successively incorporated with the dough.

Another use of the acid is as a beverage: mixed with water, and sweetened, it has an acid flavour, which is very agreeable to most persons. This may seem a matter of small importance commercially, but the quantity of beverages of this character consumed with us, as in England, is very great. Of course it can be charged with carbonic acid, and bottled, just as other so-called lemonades are sold. I believe the acid (a 10 per cent. solution) is already on sale in London for this purpose, but, as I do not wish to be an advertising medium, I must leave it to be brought to your attention in other ways.

Still another use is as a table acid. The acid is less sharp than vinegar, and what its future in this direction may be I do not venture to predict.

The most important question of all remains: Is the acid wholesome, and are the uses suggested above legitimate uses from a sanitary point of view? I dare say there are others here who can speak with more authority on these points than I can. I am not a medical man, although I have been long interested in sanitary matters.

I believe there is no question as to the wholesomeness of sour milk, at least in reasonable quantities, and it is a staple article of food in many localities. With us—as I presume is the case in England also—it is thought that there is nothing more wholesome than bread and cakes raised with sour milk and soda. The great trouble is that, the sour milk not being of a uniform degree of sourness, there is great danger of spoiling the bread with an excess of soda, or of having sour bread, on account of not adding soda enough. This trouble is, of course, obviated by the use of an acid of known and invariable strength. The lactate of soda (or the lactate of lime and soda, which results if the acid lactate of lime be employed) would no doubt be quite as wholesome as the Rochelle salt which is left in bread raised with a cream of tartar powder. I am not aware of any accurate experiments on the physiological action of the lactates taken in this way, but the general effect of the compounds seems to be sedative and slightly soporific.

How far the use of the various acid beverages which are consumed—especially in the summer, to an enormous extent—how far such use is advantageous, and what dangers there may be in excess, I will not attempt to investigate. At any rate, sour milk or a pure lactic acid is probably as wholesome a substance as can be used for the purpose. The opinion has also been expressed by medical men that, as an anti-scorbutic, lactic acid should rank with citric acid, and that it should form a part of the supply of vessels fitting out for Arctic voyages.

There is one other point to which I should allude. I saw recently an article by Dr. Richardson, in which he states that lactic acid is excreted in the system in the case of certain diseases. Lactic acid, or rather a variety of lactic acid called sarcolactic acid, has been thought to be a normal constituent of the gastric juice and of healthy muscle; and, I presume, the acid referred to by Dr. Richardson is sarcolactic acid, and not the lactic acid of fermentation. Although these two substances have the same percentage composition their chemical action is quite different, and their physiological action would probably not be the same. At any rate, even if the lactic acid of fermentation were formed in the system under certain abnormal conditions, it does not follow that the acid would be unwholesome to a person in normal health, any more than it follows that sugar should be banished from among articles of food, because in diabetes, for instance, a sort of sugar is found in the system, and eliminated in the urine.

BEE-KEEPING.

CONFERENCES BY THE BRITISH BEE-KEEPERS' ASSOCIATION ON FRIDAY AND SATURDAY, JULY 25th and 26th.

FOUL BROOD: ITS PROPAGATION AND ITS CURE.
ADULTERATION OF HONEY.

CONFERENCE ON FRIDAY, JULY 25, 1884.

BRITISH BEE-KEEPERS' ASSOCIATION.

Rev. HERBERT R. PEEL, M.A., in the Chair.

THE CHAIRMAN, in opening the Conference, said it was on a most important subject. Mr. Cheshire had, he knew, devoted a great deal of trouble to, and had spent a great deal of time and mental labour on the paper he was going to read. He would say nothing with regard to what he anticipated from the paper, but to show the practical importance of the subject he would read a letter he had received from a cottage bee-keeper, and a portion of another from Mr. Cowan, who was now in Switzerland. The latter gentleman wrote: "I particularly regret that I am not able to be present at the reading of the papers, as both the subjects are specially interesting to me. With regard to Mr. Cheshire's paper on Foul Brood, it will be very interesting if he can throw some light as to the cause of this disease, which seems, up to the present, to be so deadly in the hands of many. It will also be a great boon if a simpler method of curing diseased stocks can be devised, and from what has appeared in the *Journal*, I see the remedy Mr. Cheshire proposes is not to cost more than 3*d.* per hive. This will be a great boon to the keepers. I have sent a translation to the *British Bee Journal* of a paper which appeared in the *Travaux de la Société Économique Impériale* at St. Petersburg by M. D. Ossipow, of whom a Russian bee-keeper of eminence, M. Zoubareff, says he is a bee-keeper of great experience. This gentleman thought of the idea of curing foul brood with camphor, and succeeded perfectly, even with stocks having the disease very badly. The process is so simple, and the cost so trifling, that I give you the process, so that any of those present can try it for themselves, and report upon it. The whole of the secret consists in giving the hive a lump of camphor (wrapped up in a rag) about the size of a small walnut. This is placed on the floor-board inside the hive, and the foul brood disappears. Besides M. Ossipow, a number of other bee-keepers have tried the same remedy with perfect success. The bacteria of foul brood do not seem to prosper in a camphorated atmosphere." The other letter was a simpler production, but it would perhaps speak more feelingly to the meeting, from a cottager at High Wycombe, in Buckinghamshire, who wrote: "I cannot get rid of foul brood ; nearly all my bees have got it, and I thought I had got rid of it. I don't think there are many free from it in this district. I shall have to clear right out I expect ; only had two swarms. It makes me disheartened to keep trying. I hope Mr. Cheshire can cure it, it will be a blessing to bee-keepers. I have found it in Surrey, Hampshire, and Berkshire, and I have known thirteen places round me that have had it, some have lost all, others some. I should be glad to know how to stop it, for it has ruined me, and I fear others will lose their bees, for some that I bought last year smelt so bad, I burnt them six weeks ago. All I bought last year I shall have to destroy this year." Of course it was a very hard case for a poor cottager, who depended very much on his bees for his income, and who devoted almost all his leisure time to them. He only hoped Mr. Cheshire would be able to suggest an answer to those letters, and to tell them something which would be of value to the bee-keeping world at large.

FOUL BROOD (NOT MICROCOCCUS, BUT BACILLUS): THE MEANS OF ITS PROPAGATION AND THE METHOD OF ITS CURE.

Mr. PRESIDENT, Ladies, and Gentlemen,—About two months since I was invited by the Committee of the British Bee-keepers' Association to address the present Congress, then to be convened in connection with the International Health Exhibition, on the absorbing but apparently well-worn topic of Foul Brood. My consent to that invitation was mainly given on two grounds: first, a confidence that I had a method of curing this terrible malady far in advance of any that had previously been brought before the bee-keeping community either by others or myself; and, secondly, that the writing of the paper would furnish me with an excuse and reason for that large devotion of time which I foresaw a new and independent investigation of the subject from its scientific side would require,—an investigation which I had long intended to undertake, in order to test facts which I had noted during previous years, and which it seemed impossible to reconcile with commonly received opinions. To these facts and to the results of my recent inquiry, so far as I have as yet been able to complete it, I now therefore ask your kind and indulgent attention, in order that we may all apprehend together the grounds upon which I venture to diverge somewhat widely from theories which have been admitted during the last seven years at least as things undisputed, because indisputable.

Apiculture is attracting more attention in this country than it has ever previously received. Bee-keepers are multiplying on every hand. The peerless late Hon. Secretary of the B. B. K. A. will know no rest until every county has its Association. From the throne to the humblest cottage the charms or the profits of apiculture are getting recognition. The bee-keeping of to-day is no more like that of the first half of this century than the goods train is like the carrier's cart. We have our combs built in days instead of weeks. Bees raise drones or workers as we give them order. Supers have gone and sections are finished as though bees had recently learned the use of the rule and the plumb-line. Honey is demanded by the ton in the manufacture of biscuits. The poor cottager may add to his comforts and his culture by attending to his hives; and yet, amidst all this pleasant prospect, seeming to promise greater things for the future, a dark cloud—causing most to fear, and even breeding despondency in the breasts of not a few apiarians—is hovering amongst us. Foul brood, despite all the information given, is now not only present, but rapidly increasing; and were it just to the owners I could point, not to diseased stocks merely, but to apiaries of sixty or eighty, where, perhaps, not one has escaped contamination. Letters daily, and lately almost every post, arrive with some sad tale of disaster which the writer fears will perchance ruin the hive-selling business which has grown up in company with his bee-keeping. If the unqueening and comb-excising or burning and starving plans must be adopted, ruin is meant, profit anticipated becomes loss realised, and hope yields to despair. Nor is the reason of this far to seek. In former days, when bees were kept in the same garden, descending from father to son, increasing their number in the spring by swarming to be reduced to the old limits in the autumn by the sulphur-pit,—when none left their native spot, except an occasional swarm, perhaps, as a gift to a near neighbour, and when none were ever imported from afar, foul brood might have lurked here and there, but the facilities for its propagation were wanting. Now, how different! Bees are ever travelling by our railways through the length and breadth of our land, these, raised often in company with many stocks where are to be found queens hailing from the Sunny South, where the disease has been often rampant, and coming, as these swarms sometimes may, from stocks not above suspicion, are, it is to be feared, but too often the instruments for communicating the germs of destruction in localities previously free. I delight, however, to recognise that this sad state of things need not, and I believe will not, continue; for, from reasons which will be presently apparent, instead of now regarding a visitation of foul brood in my apiary as a terrible disaster, I should esteem it as a trifling and temporary inconvenience very far less grave than the loss of a queen. Let us now consider the subject under three heads. Firstly, the nature of foul brood as a germ disease; secondly, the means of its propagation; and, thirdly, the methods of its cure.

1. *The Nature of Foul Brood as a Germ Disease.*—The appearance of foul brood is undoubtedly familiar to almost all before me. A larva, if attacked early, begins to move unnaturally, and instead of lying curled round on the base of the cell frequently turns in such a way as to present its dorsal (back) surface to the eye of the observer. A little attention will then show that the colour of the larva is inclined to yellow instead of being pearly white. Such grubs are only rarely sealed over. Those more advanced before the disease strikes them are in due course sealed, but death overtakes them, their bodies become brown and fœtid, and the sealing sinking gets pierced by an irregular hole. From this may be gathered the general indications of the disease, which is usually accompanied by very energetic fanning at the hive mouth, from which in advanced cases an indescribable and nauseating odour is emitted. The larvæ and chrysalids dead of the disease dry up to a coffee-coloured, tenacious mass lying at the bottom of the cell, so tenacious, indeed, that it may be drawn out into long threads like half-dry glue. The drying

process completed, a blackish scale is all that remains. This was formerly supposed to be the only condition in which the foul-broody matter so called was a centre of infection, but we shall presently discover that this notion has no foundation in fact. The disease *is* terribly contagious, and once started soon spreads from cell to cell, and not infrequently from stock to stock. The knowledge of bee-keepers extended little beyond this in December 1874, when a translation from the German of Mr. J. S. Wood, of Nyborg, gave an account of some experiments by Dr. Schonfeld, which may be thus summarised. Some foul-broody matter was placed on a plate pierced by a hole, below which, and passing into it, was a glass tube 2 ft. long, a bell-glass covered the plate, and bore another tube inserted into a hole in its crown. The lower tube was perfectly open, but the upper one was plugged loosely with cotton wadding. The sun shining on the glass warmed the contained air, and a current was produced. Dr. Schonfeld describes the foul-broody matter as being full of micrococcus, and, examining the cotton wadding, he tells us he discovered innumerable micrococci. Some of this wadding was placed over larvæ in a hive, and the larvæ were removed three times, but upon the fourth experiment seven larvæ died, their bodies being found full of micrococci. He also informs us that blowfly larvæ, by the cotton wool being placed upon them, contracted the disease, and the bodies upon examination revealed innumerable micrococci. These experiments were accepted as so satisfactory and conclusive that the matter here rested; and again and again I examined microscopically, specimens of foul-broody matter sent to me without for a moment suspecting the very serious error underlying these observations, upon which I do not wish to cast any discredit, although two very accomplished microscopists whom I have consulted agree with me that any supposed observation of micrococci on cotton wool could only be accepted with extreme caution.

But the fact of being able at once to spot foul brood by a microscopic examination of the coffee-coloured matter was an advantage. In October 1879 a well-known bee-keeper sent off two small brown masses found in a super, one to the *British Bee Journal* and the other to the *Journal of Horticulture.* The latter came to myself, and I pronounced it foul-brood instantly I saw it under a power of 500 diameters. The *British Bee Journal* affirmed it simply dried pollen, a pardonable mistake. But the bitter scolding I received in the aforesaid journal for my folly in pronouncing this to be foul brood induced me to visit the apiary from which it came, and in which every stock turned out to be a prey to the dread malady. The microscope here was the means of starting remedial measures ere too late.

In spite of all that has been written or said since that time, we appear, so far as the nature of the disease is concerned, to have made no advance. The expressions "Bacteria,' 'Fungus,' 'Micrococcus,' have been used without any very definite ideas lying behind them, and there the matter apparently has rested. Before attempting to explain what I venture to believe the disease actually to be, it will be necessary to give a few definitions and explanations.

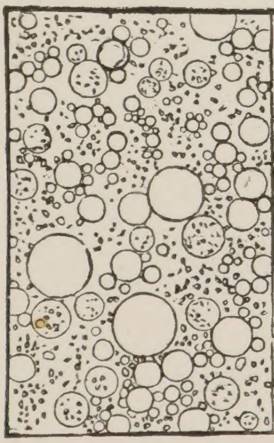
Science has recently shown that all putrefactive changes, fermentations, and very many diseases, are brought about entirely by minute organisms, which are in fact rudimentary vegetables. To them the general name of Schizomycetes has been applied, because their method of increase is by splitting or fissuration.

These micro-organisms are divided into four genera—micrococcus, bacterium, bacillus, and spirillum. We shall presently see that two only of these, micrococcus and bacillus, are essential to our present purpose, and so the others will be left out of view. There are many species of each, and they may be classed as,—septic, those causing putrefaction ; zymogenic, causing definite chemical changes, such as butyric fermentation ; chromo-genic, or colour-forming, and pathogenic, or disease-producing. Confining our inquiry within the narrowest possible limits we have to do with pathogenic micrococci and bacilli. The former may be roughly described as minute globular bodies, which at intervals become slightly elongated, and then show a compression at what may be called the waist, giving them the form technically known as the dumb-bell. The compression becomes more pronounced until by separation two tiny globes are produced from the one ; each of these will in turn divide, and so multiplication may go on at an astounding rate. Bacilli, on the contrary, are rod-shaped, and if we could suppose a common ruler to elongate without increasing in thickness, and then at a definite point break into two, to again increase in each part in like manner, we should have a fair idea of the whole matter ; but sometimes this increase in length is not accompanied by separation, so that a line of bacilli may be formed comparable to a long string of sausages, and such is denominated a leptothrix. Under certain conditions, however, the bacilli produce spores (or seeds), which the micrococci never do ; while in addition bacilli, unlike micrococci, are provided at their extremities with wondrously delicate filaments called flagella with which they strike the fluid containing them, and so swim much as a fish does by the use of its fins ; so that shape and the power of spore-production and self-directed locomotion sharply divide one from the other.

This explanation, for the introduction of which no apology is needed, since upon it turns a right understanding of the line I took in the inquiry, will, I trust, be sufficient to enable even those who have not studied the question of micro-organisms at all to follow the details now to pass before us, concerning which I must express my thanks to G. F. Dowdeswell, Esq., M.A., member of the Council of the Royal Microscopical Society, for the lively interest he took in my investigations, and for the many helpful suggestions he gave me. I happily mentioned to him at one of the Royal Microscopical Society's meetings the work in which I was engaged.

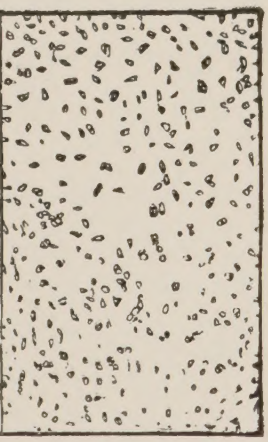
Taking a small quantity of the juices of a healthy grub, and spreading it out under a thin glass under the microscope, one is presented with such an appearance as is seen at Fig. 1, fat globules are numerous, while blood-discs abound, and everywhere may be noticed tiny particles which are constantly slowly dancing with what are called Brownian movements; but if a speck of coffee-coloured, foul-broody matter be similarly treated, we find neither fat globules, blood-discs, nor molecular base, but observe the field crowded with very small ovoid bodies, as we have them represented at Fig. 2. These are the micrococci of Schonfeld, but if this substance be stained according to the modern plan of Weigert and Koch, and then carefully examined, in all probability we shall discover, associated with the ovoid bodies, a very few other organisms, longer and rod-shaped, while we notice that the so-called micrococci are neither round nor dumb-bell like, but oval, or boat-shaped. This led me at once to suspect an error, and further searching showed me if, instead of coffee-coloured matter, such as that usually sent for microscopic examination, the body of a grub, dead, but in a fresher condition, were taken, the number of the rod-like bodies very considerably increased, while that of the ovoid ones diminished, as seen in Fig. 3. My own inoculated stock,—inoculated for experimental purposes,—was cured, and gave me no material, but soon I obtained a comb from a suffering hive, and then had the opportunity of expressing

Fig. 1.



Healthy juices.

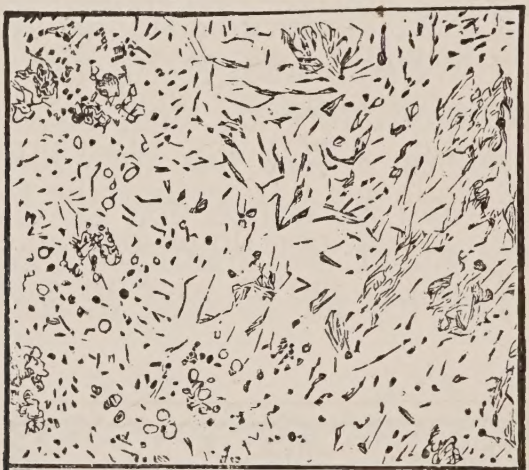
Fig. 2.



Foul Brood, last stage.

the juices from a death-stricken larva. These, when examined under a power of 600 diameters and carefully illuminated, were seen, to my great delight, to be full of active rods, swimming backwards and forwards, and worming their way between the degenerate blood-discs and fat globules, as represented in Fig. 4, while here and there were long strings of them, the leptothrix form previously referred to. Three questions now required answers. Was this undoubted bacillus always associated with foul brood? If so, was it cause or effect? If the cause, what was its life history? It would weary to explain how these answers were obtained, as the work involved many days' incessant application at the microscope, the preparation and comparison of about 200 microscopic slides, and the rough or somewhat careful dissection of at least 100 grubs, taken from various hives, in different conditions of the disease,

Fig. 3.—Late stage.



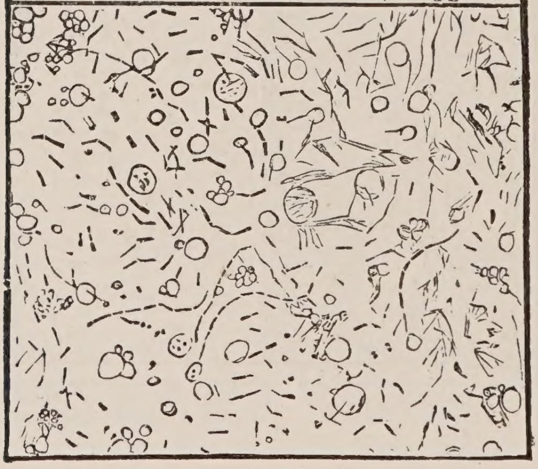


Fig. 4.—Early stage.

and at sundry periods after their removal from their respective stocks. I found that in every instance the beginning of the attack was marked by the appearance of bacilli in the blood, that these bacilli were in many cases at first long, thin, and marked by the presence of bead-like points; that as this form disappeared the bacilli, pure and simple, multiplied by repeated division, that these bacilli, when magnified about 1300 diameters, presented the appearance seen in Fig. 5, that these were active, swimming rapidly either backwards or forwards, and that when an end view could be obtained of one of them, it was seen to be describing a small circle; that when the disease was in rapid progress leptothrix forms were common, some of them reaching even the 1-100th of an inch, or 250μ[*] in length; that as the fluids of the grub failed by loss of fats and albuminoids, the bacilli put on the spore condition. They widened and drew up their protoplasm or mycoprotein from their extremities, as we see indicated in Fig. 6, and thus became what Schonfeld had in error called micrococci.[†] That after the death of the grub, and during the assumption of the viscid, putrid condition, this constant alteration of bacilli into spores continues. After removal from the hive it goes on so rapidly that in three or four days scarcely a bacillus as such is discoverable, but the spores are innumerable. The reason of Schonfeld's mistake so far is intelligible, he saw the spores only, and judged them to be micrococci; but the continuance of his

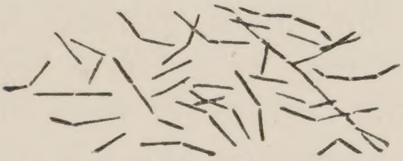


Fig. 5.

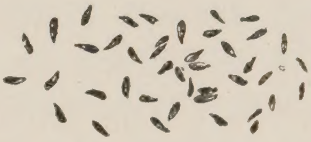


Fig. 6.

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[*] μ or micromillimetre = $\frac{1}{25000}$ inch nearly.

[†] The greater number of bacilli in this way produce two spores. The determination of this point requires extremely careful illumination and high powers of fine quality. The other facts may be witnessed by a good quarter, aided by an achromatic condenser.

error through all his investigation is a mystery which I am quite unable perfectly to explain.

Foul brood, then, is a bacillus disease; and in these days, when the "germ theory" is the question of questions amongst pathologists and physiologists, it is extremely interesting for us to note that science has lately shown that different species of bacilli also cause consumption, cholera, typhoid, leprosy, and many other diseases afflicting the human family; whilst amongst animals, glanders, splenic fever, sepitcœmia, &c., arise from a similar cause. This particular bacillus seems not unlike *Bacillus anthracis*, which the researches of Pasteur have lately brought so much before public attention. Since the force of conviction thus obliged me to contradict the conclusions of Schonfeld, I felt it incumbent upon me to repeat his experiments; for if the disease be really a bacillus, how could the communication of it to the larvæ of *Musca vomitoria* (blowfly) produce, as he says, micrococci in that insect? I experimented on 60 individuals: 20 were not brought near foul-broody matter, 20 I attempted to infect with bacilli in their active condition, and 20 by spores. At the end of 24 hours I examined carefully two from each lot, but with no apparent result. In 24 hours more, two again, but still failed to see any evidence of disease. By a further delay of 24 hours, one of those infected with coffee-coloured matter was found to have a pretty considerable number of active bacilli swimming in its fluids. The non-infected showed many micrococci. This was most completely confirmatory of my position; but how could it be reconciled with Schonfeld's assertion, that he found the dead flies full of micrococcus. Had he searched further, he would have discovered that dead blow-flies are generally full of micrococci. They take in with their food (decomposing flesh substances) swarms of septic micro-organisms, and these at their death multiply within them; but any observation carefully made with a decent instrument would show the immense difference between these micrococci and the spore condition of the bacillus. Schonfeld's last assertion that by means of these micrococci he established foul brood in the larva of the bee, and found these larvæ containing innumerable micrococci, is past my comprehension. The only solution, if we accept these statements, that I can at all suggest is that the Brownian movement of the molecular base of the fluids was mistaken for micrococci; but this supposes most unskilful observation and possibly a very poor instrument, while, for anything I know, Dr. Schonfeld may be possessed of ample skill and elaborate appliances.

I cannot refrain from expressing my conviction that it is much to be regretted that so misleading an account of experiments, to all appearances conclusive and complete, should have been given to the apicultural world. In their absence, it is hardly possible that we could have all been in the dark so long. I find in my notes that actually eight years ago I saw these bacilli, and should very possibly have not allowed the observation to drop unless I had felt that the question of foul brood was a sucked orange. Not a few others of us from a similar cause have been kept from the path of discovery.

But in yet another way I have striven to prove irrefragably that the etiology I have given is correct. Taking a number of well-developed drone larvæ from a healthy stock their juices were expressed and strained into two test tubes 3 inches long and ½ inch wide. No. 1 now received a very minute quantity of coffee-coloured matter containing spores mostly, while No. 2 was infected with a trace of bacillus-containing fluid from a larva just dead. These test tubes were each supported by a tin slip having a hole in its centre through which the tube passed, but the lip could not, and they were thus suspended loosely corked between the frames of a stock so that the exact temperature for germination should be kept up. In twenty-two hours, I found the spores had in large part disappeared, and that bacilli in threads existed in considerable numbers, while the bacilli added to No. 2 were increasing by division, proving again that the spores produce bacilli so soon as they pass into conditions for germination, the reverse process obtaining when these conditions cease.

For many years I have entertained the conviction that the often-repeated statement that the disease affected the brood only was not merely not proved, but opposite to the evidence at our command. This statement has been again and again made as though it were as certain as that "two straight lines cannot enclose a space," but I am glad to note that Mr. Cowan has shown that deeper insight which is the outcome of scientific training, as he merely says: "foul brood does not *seem* to affect the bees."

We may take away two or three frames containing 5000 larvæ each from a stock, and it will continue to progress pretty much as though it had lost nothing, while if foul brood attacks and kills say 1000 of its grubs, it, as a rule, very perceptibly diminishes in strength. The only explanation that appears is that the bees die with the disease, but that according to a necessary instinct they leave the hive and finish their course alone. I, therefore, resolved to try to settle this point. Going to the experimental hive, then in my possession, I noticed one bee nearly dead on its back, another hopping in abortive flights of 3 or 4 inches, and presently found a third and fourth worn out and too far gone to enter the hive again. The first bee contained nothing remarkable, but the second was almost an empty shell, the air sacs occupied nearly all the abdomen. The stomach and colon were exceedingly small and the amount of fluid I could obtain truly microscopic, but this was enough for the microscope, which showed it at once as full of active bacilli. The question was answered. The large consequences flowing from it were clear. Swarms must no longer be stated as incapable of carrying the disease. Bees from a presumably clean hive if in an infected apiary may carry the infection. And so, to set all at rest, I placed the bee in spirits, and now offer it to the Committee of the B. B. K. A.,[*] who may, if they please, put it into the hands of any microscopist of repute for examination; but this bee is not needful, for Nos. 3 and 4 gave me similar results, and so have some others since, making it clear that a very large proportion of imago (adult) bees from a foul-broody stock, die of bacillus, or, as Mr. Hooker remarked to me a few days ago when talking of this matter, 'In a foul-broody stock the candle is burning at both ends.'

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[*] The bee is now in Mr. Huckle's keeping.

This discovery is pregnant with consequences. As workers and drones are liable to it, why may not queens suffer from it? Although I have had, of course, no opportunity of giving direct evidence here, analogy says they must; and if so, may not those who assert that imported queens have introduced foul brood be after all right? In a case occurring to myself last year, a Ligurian queen was successfully inserted and laid fairly, but foul brood appeared and she died. At that time I did not connect the circumstances, but they rise to my remembrance and bring a doubt. Further, if the queen may be infected, why not the egg? So far as I have been able to go, I believe it occasionally is. Some would say the size of the egg would forbid this, but these spores are relatively minute. The egg is $\frac{1}{14}$ of an inch long and $\frac{1}{70}$ inch in diameter, yet it could contain above 100,000,000 bacilli in the spore condition, the spore being no more in relation to the size of the egg than a single drop would be in a cistern containing 1500 gallons of water. The investigation of this point I must leave to others or to the future, as it may be necessary to infect one of my stocks, and it would also appear to be necessary to infect the queen to get the eggs in proper condition; but great caution will have to be exercised, as the sources of error are so numerous and the manipulation so difficult, but an example in point is at hand which shows that the idea is not improbably correct. 'Carpenter on the Microscope,' p. 375, says:—

> "A most notable instance of such propagation is afforded by the spread of the disease termed "Pébrine" among the silkworms

of the south of France; the mortality caused by it being estimated to produce a money loss of from three to four millions sterling annually for several years following 1853, when it first broke out with violence. It has been shown by microscopic investigation that in silkworms strongly infected with this disease, every tissue and organ in the body is swarming with minute cylindrical corpuscles about $\frac{1}{6000}$ inch long; and these even pass into the undeveloped eggs of the female moth, so that the disease is hereditarily transmitted. And it has been further ascertained by the researches of Pasteur, that these corpuscles are the active agents in the production of the disease which is engendered in healthy silkworms by their reception into their bodies, whilst if due precaution be taken against their transmission, the malady may be completely exterminated."

A matter for consideration now presents itself of some moment. The name foul brood has been given under a misapprehension, and is manifestly inappropriate since the disease is not specially of the brood at all. Popularly it may yet pass, for the title is so crystallized into bee literature that it would be difficult to displace it, but scientifically it cannot be admitted, I, therefore, with due respect, claim the discoverer's privilege of giving a name which shall represent generically and specifically what the disease really is. I suggested to the Rev. Herbert R. Peel that he should be sponsor to a new name meaning Bacillus of the hive. He consents, but his sponsorship will, I am sure, in this instance, consist not in training and guarding, but in pursuing to the death that terrible and nauseous pest hereinafter to be called *Bacillus alvei.* Let us now turn to our second point.

2. *The Means of the Propagation of the Disease.*—Although the methods of propagation of this disease are in all probability varied, and, as yet, not in detail fully understood, it may be said without hesitation that the popular idea that honey is the means by which it is carried from hive to hive, and that mainly through robbing, is so far an error that only occasionally and casually can honey convey it from stock to stock. I have searched most carefully in honey in contiguity with cells holding dead larvæ,

have examined samples from stocks dying out in rottenness, inspected extracted honey from terribly diseased colonies, and yet in no instance have I found a living bacillus, and never have been able to be sure of discovering one in the spore condition ; although it must be admitted that the problem has its microscopic difficulties, because the stains used to make the bacilli apparent attach themselves very strongly to all pollen-grains and parts thereof, and so somewhat interfere with examination. This is quite what would have been anticipated, because honey by its very viscosity is somewhat antiseptic, and the rapid movement of these especial micro-organisms, which seem essential to their propagation, is prevented by it. I have tried infecting honey and growing bacilli in it, but without the smallest approach to success.

Nevertheless, to feed honey taken from foul-broody hives (or, as I ought to say, hives infected with Bacillus alvei) to healthy ones without taking some precaution would be absurd ; but boiling is neither the most convenient nor the best plan, as we shall see presently. I anticipate here the question, Is honey taken from diseased bees fit for human food ? Morally, I should object to sell for table purposes honey which had been stored in the fetor of a diseased stock, but scientifically I could see no cause for impeachment if the flavour of the honey were good, for the chance contamination of a bacillus would be no risk. Even pathogenic bacilli may be swallowed, apparently without harm, if there be no internal rupture of the mucous membrane, while human saliva, containing as it does micro-organisms, derived from the air, will often kill small animals if a particle of it be inserted beneath their skins.

My belief is that the grubs are most usually infected by the antennæ of the nurses. These travelling in the darkness of the hive become aware of the condition and needs of each occupant of the brood-cells by constantly inserting their antennæ, which must continually, where disease reigns, be brought into contact with larvæ full of bacilli, and also into contact with those sticky masses into which the larvæ change about two days after death. The removal, then, of spores is highly probable, and these transferred to the next grub fed will there start the disease. These sticky masses will be found, too, to extend to the very front of the cells, and as the bees perambulate their combs, the claws, or more probably the pulvillus, which stands between them will be in danger of removing spores, and depositing them upon other cell-edges, to infect other grubs at the critical time of cocoon-spinning.

The supposition that in the dried condition of the dead larva the *micrococci* (?) are thrown off into the surrounding air must be replaced by facts founded upon observation. The first authorities are in general agreement that micrococci are not thrown off at all; and even if their opinion stood the other way, it would not affect the question, since I hope I have successfully shown that no micrococci exist in these dried larvæ. If it were otherwise, the face of every honey-cell would be closely dusted with death-dealing germs, and the case would appear hopeless; but this is not contradicting that it is possible, or even extremely likely, that the tramp of the bees does frequently detach numbers of spores which fly about in the air, and settle here and there, often where they take effect, many of them being carried into healthy stocks by the indraught set up by the fanners. When a hive is robbed, I strongly incline to the belief that it is rather the feet and the antennæ which carry infection home with the robbers than the honey in their sacs. Indeed, the ordinary opinion would appear to have no better foundation than very many other of the guesses which have impeded the progress of truly scientific apiculture; and I find Mr. Cowan remarking nearly six years ago, "The honey which is supposed to contain the spores, although I must say I have never been able to detect any by the microscope." This part of my subject is extremely difficult of positive proof, but with a body of acts before us our conclusions are not likely to be seriously wide of the mark. A very large number of observations has shown me that the disease is not found at all, except as infrequent exceptions in the digestive tube of the larva, but it lies wholly and absolutely in the blood ; but did honey convey it we should certainly often see its traces in the alimentary sac. In the adult bee, on the contrary, the disease, although present in the blood, is generally very acute in the chyle stomach, and the effects seem to be those of consumption of the bowels. The reason for the difference I have no time now to explain, but will simply point out what I believe no observer but myself has discovered—that the bowel of the larva is cast off with the skin at the time the chrysalis condition is assumed, and that the digestive apparatus of the imago bee is an entirely new and different organization from that possessed in the larval state. The size of Bacillus alvei is exceedingly minute, about 1 μ in diameter, and from 3 μ to 5 μ long, or, to put it popularly, such that a quadruple string of them extending from London to New York could be formed out of one cubic inch of material. Ordinary dust-motes to these organisms would be like hens' eggs to sand-grains, so that the difficulty, if any had been felt, respecting their being carried about, should vanish. Nor is their multitude less astonishing. I have examined many grubs which must at least have contained 1,000,000,000 of them. A statement which, after inspection of the many microscopic slides I have prepared, will be accepted without question. In the royal jelly, so called, of a queen dead of bacillus, I could discover no bacilli, nor have I succeeded better with the food provided to the workers, notwithstanding that I examined several hundreds of the cells containing feeding grubs, surrounded by dead larvæ ; so that, although I would not dogmatise, my strong opinion is, that commonly neither honey nor pollen carry the disease, but that the feet and antennæ of the bees usually do. I also think it probable that occasionally, at least, nurse-bees infected bring the disease-germs to the mouth in feeding the larvæ, and then, turning foragers, leave a germ or germs in the nectary of a flower, which visited by another bee becomes the means of infection to it ; the malady is thus carried by adult bees into other, and perhaps somewhat distant, apiaries. Balancing all the probabilities, it would appear that most generally the adult bee takes the disease, and then carries it directly or indirectly to the brood. An ailment of a rather different kind, from which the house-fly suffers, is known to take effect by its germs settling on the spiracles, or between the abdominal rings. The spiracles of the larva of the bee may also be the especially vulnerable points. But it is time I hurried on to the third, and practically the most important, section of my paper.

The Method of Cure.—Those whose apiaries are suffering from the ravages of foul brood have had two classes of advisers: those recommending curative measures, and those counselling destruction. The former class has been but a small one; and I remember that years ago Mr. Cowan and myself almost stood alone in this matter. We had had, unfortunately, to deal with foul brood; we had attempted curative measures, and had succeeded. We were anxious that others should share the knowledge of our methods of treatment, for they were not identical; but from reasons, which from my point of view I will endeavour to explain, the destroyers seem for the moment to have the best of it. Sometimes the word cure has been wrongly used; and that has been denominated a cure which has been only an uncertain means of eradication, always involving severe, and sometimes ruinous, sacrifices. It is my high hope that what I shall have to say presently will deal a deadly blow to this work of queen-killing, comb-burning, and starving, which makes British apiculture, handicapped, as it always must be, by the shortness of our summer and the uncertainty of our climate, too precarious a matter to permanently hold its way as a means of recreation to the many, or as a means of livelihood to the few.

Salicylic acid has been the substance which has been hitherto constantly used as a remedial agent; but it has had three main difficulties to contend with. First, it is troublesome in application; next, the question of dose has never been properly worked out; and lastly, it has, from a mistaken idea of its insolubility, been associated with borax, which has reduced its curative effect, and made the treatment somewhat dangerous.

1st. It is troublesome in application. It has been recommended to uncap the dead nymphs, removing their bodies when possible, and to spray the combs and frames thoroughly, and next feed with syrup containing salicylic acid. All this must be done regularly and through a considerable period. My observations (for I have been intending to address the Association upon this question for a considerable time), more especially during the last three summers, lead me to believe that the good effects almost all arise from the food, and that the spraying is often a mischief instead of a benefit. 2nd. The question of dose has never been worked out. Mr. Cowan recommends $\frac{1}{80}$ salicylic acid, $\frac{1}{80}$ borax as a spraying fluid ($\frac{1}{40}$ of the whole); or if the drugs be bought by troy weight, which they almost certainly would be, $\frac{1}{37}$ of the whole, while my formula was 25 grains in 8 ozs. water, or 1 in 140; and Mr. Hilbert recommends 1 in 200. In addition, spraying is a most uncertain and variable quantity. One man will soak combs and bees by the spray, another will only damp them. I think in any case $\frac{1}{40}$ too high a proportion. Three weeks since I received a comb in a box, accompanied by a letter, asking what was to be done. (The letter may be seen privately.) Foul brood had broken out, and salicylic had been used, but without benefit. The comb contained a large number of dead grubs; and I commenced a microscopic examination, expecting to find the usual living bacilli, and in other cases the spores; but to my bewilderment, the first eight dead larvæ contained neither bacillus nor spore, the ninth was filled with the former, and had undoubtedly died of the disease in the normal way. But what of the others? My suspicion was that they had been poisoned by excessive drugging, and writing at once for details, I obtained information which puts the suspicion beyond doubt. Mr. Raitt some years since complained that salicylic acid was a humbug, and gave as one reason that he had used so much that he had killed the grubs, and yet it did not cure. Depend upon it, the order of mind that concludes if 1 oz. of salts will keep off a bilious attack for a fortnight, ¼ lb. will keep it off for two months, exists in the bodies of many bee-keepers amongst the humbler classes, and so the extremely uncertain quantity given by spraying has its dangers, besides which, spraying chills terribly, and takes all pluck out of the bees. Salicylic acid is a poison. I, with others, have said differently, but I eat my humble pie, and acknowledge my error. The French Comité Consultatif d'Hygiène Publique has twice reported against the employment of salicylic acid, even in small quantities, as a preserving agent in food. These reports have been strongly opposed by interested parties; but it has been shown that it has frequently acted as a cumulative poison, and has in several instances proved fatal. (Abridged notice from *Practitioner* of this month.)

The borax shall be dismissed with a word. It does nothing but, by making a new compound with the salicylic acid, gives it great solubility. Using hot spray as I have recommended makes it needless. It adds to the complexity and nauseousness of the remedy; and I notice Mr. Cowan, in the last edition of his 'Guide-book,' which he most kindly sent me, has substituted Hilbert's for Muth's formula, and so omits the borax. But Mr. Cowan now introduces to us Bertrand's Fumigator. If all bee-keepers were as scientific as Mr. Cowan I should believe in its being a great service; but it is simply a subliming apparatus, in which for every sized hive, and every strength of stock, and every possible number of frames, 15½ grains of salicylic acid must be used. The dose seems to have been worked out here with great refinement; although no doubt the 15½ grains is but the equivalent of 1 gram named as the quantity by M. Bertrand; but when we call to mind that at 156° C. salicylic melts, and at 220° decomposes; when we remember, too, that in chilling the acid drops in a dew, we can easily see that one operator with the same 15½ grains would get twenty times as large a quantity into the hive as another; and so my hope of Bertrand's invention is but slight indeed. The plan, too, of feeding with medicated syrup those stocks that are not but may be attacked, is one that I think the best understanding of the case would not recommend, at least I do not now join in the recommendation. A drug is, by its very nature, a poison, and even though only used as a prophylactic, must have its damaging effect. But I must spend no more time in slaying a dead lion, for such I believe the salicylic acid cure will soon be amongst British bee-keepers, but must spend a moment or two with the advocates of destruction.

I am not by any means well acquainted with apicultural literature, and so do not know by whom or when the idea of shutting diseased bees up until their honey was consumed before putting them into their permanent home was originated. Mr. Simmins gave it as the plan he adopted, but I suppose not as his invention, since I find identically the same in King's 'Bee-keepers' Text-book,' published 1872. I would here only say, that with our present knowledge, that in a swarm taken from an afflicted hive many at least of the bees are themselves filled with bacilli, we can see that the plan of shutting up is the very worst that could be adopted. The bees that drop, as Mr. Simmins suggests, "from exhaustion" would most probably be those dying of foul brood, and being confined (the stricken with the sound) are likely to perpetuate the disease. The real benefit arises here not from consuming the honey as I have shown, but from delaying the time of egg-production, and so letting the diseased bees die off before they have a chance of acting as nurses. If this ruinous, and to me cruel, plan were in any way necessary, I should say, unqueen your diseased stock, cutting out all queen-cells ten days after, and giving from a healthy colony a cell just sealed. When the queen hatches make a swarm of the whole into a skep, and transfer next day to a frame-hive. The skep is only needful because making the swarm is likely to throw spores into the air. The queen will in eight or nine days begin to lay, and all would most probably go well, much more probably than by the starving plan. The diseased bees would be dead and gone before any nursework commenced. All the brood that will hatch is secured, and the queen gets no chance of contamination by constantly putting her abdomen into infected cells, a possible contingency if she be allowed to begin ovipositing in the old and diseased stock. My last point is reached—the method of cure which I suggest.

About three years since Mr. Robert Sproule, an Irish gentleman of culture, with whom I several times had the pleasure of a conversation, mentioned to me that he had used phenol in the treatment of foul brood with a good deal of success. I replied that I would seek opportunities of experimenting, and if I found the result advantageous, I would do as I am always glad to do, mention his name with thanks for the suggestion. The suggestion was, however, not quite novel, but no one appears to have done more than think that phenol was out of the question: bees would not take it. This idea is correct, and I find by a letter received from Mr. Sproule, dated 18th ult., that he with the remedy in his possession, for want of noting the way of giving it, lost a large part of his apiary. Mr. Sproule's plan was to feed with syrup, into which he put a small quantity—how much I do not know—of Calvert's No. 1 Phenol. He says in 1882 he was successful with it, "but" —I quote from his letter—"unfortunately I re-queened all my stocks, save one of black bees, with Ligurians. The disease reappeared, and as the Ligurian bees refuse to take the carbolised syrup, I lost them all by foul brood, save and except the black stock aforesaid."

"What man has done man can do" was my motto, and I sought opportunities of treating the pest, and up to the close of 1883 had so manipulated six diseased stocks that I felt convinced I had that with proper management a remedy beside which salicylic acid was but vexation of spirit. I imagine that with Mr. Sproule's method I should have failed as he did, as I operated entirely on Ligurians and hybrids. (The former bees are as much in repute with me as they have ever been.) Reference to my writings in the *Country* newspaper ten years since shows that my argument has always been in favour of the remedy being given in the food. We have here a constant quantity; every grub must receive the same amount of nourishment, and if we can find a curative agent and the dose, the difficulty is accomplished. I wrote thus seven years since in speaking of salicylic acid: "When combs are in a very decomposed condition they may have to be taken away, but I do not believe, rather I have not found, this step to be necessary. It is, in my opinion, far more necessary to remove the store, for, supposing the honey to carry no infection, it is at least the means of preventing one remedy being given to the grubs. Remove the store, and the bees themselves become the dispensers of the drug we have provided."

To place the food-bottle with added phenol on the hive will, however, do nothing in the greater number of cases. If honey be coming in the bees will not touch it, but open the stocks, remove the brood-comb, and pour from a bottle having a dropping-tube, loosely placed in its neck, the medicated syrup into those cells immediately around and over the brood, and the bees will and do use a curative quantity of phenol. The syrup is best poured in by holding the comb at about the inclination of ordinary writing, not by placing it on its side.* Sometimes it is enough to simply pour the syrup into the back comb, when they will fetch it into the brood-nest as needed, and the disease will disappear. But success comes through failure, and I had to experiment and destroy stocks in experimenting in order to find the curative dose. The vapour of phenol, the phenol being poured on blotting-paper on two occasions, killed all the brood. Last autumn I inoculated a stock and allowed it to get into bad condition. I then inserted a comb of store in the centre of the brood-nest and treated one side. The disease disappeared, but raged, although with abated fury, in the other half. Possessing myself of a skep which might be scented from afar, I divided the combs by transferring into two of my stocks, and after allowing the disease to get ahead, quickly had them perfectly sound again.

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* For tender combs an appliance may be made like a chemist's wash-bottle, by which the combs can have the syrup poured into them while they are in the upright position.

Having found that $\frac{1}{200}$ was refused by the bees altogether; that $\frac{1}{400}$ might be given constantly to a sound stock without appearing to limit the queen in breeding or touch her health; that $\frac{1}{500}$ despatched foul brood quickly even while honey was coming in, and that $\frac{1}{750}$ appeared enough when it was not. I have established these quantities as the correct ones. I then, in the interest of apiculture, requested the British Bee-keepers' Association to provide me with a bad case, so that the attention of bee-keepers might be arrested. The colony has been supplied me by the kindness of Mr. Mills, and has been open to visitors, marked by Mr. Hooker, and officially attested. When it arrived on the night of June 21st it contained seven frames, only enough bees to cover two of them, and queen-cell afterwards found to contain foul-broody matter only, scarcely any living brood and a good deal of dead. A casual counting of one of the best frames gave 371 dead larvæ on one side. The odour was pronounced. A case such as this would have been utterly hopeless on any plan but the one I am now advocating.

With me queenlessness presents the worst of all difficulties. No grubs, no physic, no cure. Unqueening a foul-broody stock is giving up at once, it is decapitating to cure the headache. I had stipulated that the hive should have a queen, so my difficulty was greater than I had anticipated, and yet the hive is here to-day, strong, vigorous, and healthy, and has been so for a week past. No cell has been uncapped, no diseased grub removed by me, my treatment has been giving food and getting that food converted into bees as rapidly as possible.

Bear with me in this over-lengthy paper while I explain my procedure.

Seeing early next morning, June 22nd, the utterly disheartened condition of the poor bees, I went to a nucleus, took out a very fine Italian mother just proved as purely fertilised, and putting her under a dome cage on a card, placed the card over the frames, the bees came up and seemed to see in her a new hope; I lifted the card, she was welcomed, and the hive was now queened. I waited three days till she was regularly laying, giving them syrup phenolated by 1 in 500, and then took two frames from a stock containing the very comb once used in experimental inoculation to which I previously referred. The combs were ugly, and I wanted to be rid of them. They were full of brood. This step would not have been necessary but from the fact that I required a strong healthy hive by the time of the Congress. The bees were now shut up to four frames, and those behind the division-board, waiting introduction as the bees multiplied, smelt so badly, the weather being hot, that for comfort of self and bees I was forced to spray with water 200, phenol 1. Every evening the medicated syrup was given. The smell vanished, the bees became active and earnest. The comb with 371 dead larvæ on one side was last added, and in six days I could only find five sunken caps in the whole of it. Now and again a grub did take the disease, but quickly perfect immunity was the issue. The brood is now as bright, pearly, and healthy as any I have seen. The hive has not been touched except for manipulation, and yet its bottom board has been kept most perfectly clean by the bees themselves.

Here a caution is needful. Carbolic acid is an impure phenol, and is useless.* It contains creosote and cresols, and bees abhor it. Absolute phenol must be used. It is difficult rather to obtain, and so I have caused some quantities to be done up with directions, lest any should desire to experiment at once. It can be had of Mr. Lyon or Mr. Hollands. My fear is lest dealers should profess to supply what is required, and substitute a cheaper for an absolutely pure article ; if so, difficulties will arise.

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* Phenylated soap of good quality with plenty of water is the best cleanser of hives and apparatus.

There is much more that I ought to add, especially upon details of treatment, and the philosophy of the curative power of phenol, but fear that I have already greatly wearied my patient hearers restrains me. Another opportunity may arise in which some omitted points may receive attention ; but in the meantime pardon me in saying that I feel proud that I have been so fortunate as to contribute something to the science of the question, while I feel delight in that the worst difficulty of bee-keepers has almost ceased to be a difficulty. I could take an apiary beginning of March with every stock diseased, and by May 1, with but very little labour, deliver it up clean and strong, as strong as though the disease had never appeared. These experiments and investigations have cost me much in time, and money, and mental effort ; but as they will, I feel assured, be the means of saving to bee-keepers generally thousands annually, I rejoice, and ask them to rejoice with me.

DISCUSSION.

The CHAIRMAN, before inviting remarks on the paper, asked Mr. Cheshire for an explanation, in as simple a form as possible, exactly of what phenol was, as he understood the cure rested mainly on its application. A short time ago a discussion took place at one of the Quarterly Conferences held in the Board Room of the Society for the Prevention of Cruelty to Animals on this subject of foul brood, and a gentleman present advocated the use of thymol. Nobody seemed to know exactly what that was until the gentleman himself stated that it was the essential principle of thyme.

Mr. CHESHIRE said there was a gentleman in the room who was far better able to take up this point than himself, and he would simply say in one word that phenol was a relative of those tar-products which had so recently attracted attention. It was closely allied to benzine, and was commercially associated with a great number of bodies to which bees had the greatest aversion ; so that unless it were used in its absolutely isolated condition it would fail in its effect. If it were put into the brood-nest absolutely pure the bees would use it at once. It should be given to the bees as part of their food, and as it had a special affinity for, and was not destructive to, those micro-organisms which are the cause of the disease in question, it speedily effected a cure.

The CHAIRMAN said he thought the meeting would now understand that phenol stood in somewhat the relation to tar that thymol stood to thyme.

Mr. OTTO HEHNER, as a non-bee-keeper, was afraid he could only appreciate the advantages which the discovery of Mr. Cheshire would confer upon bee-keepers, but he could say that a more thoroughly scientific paper he had never listened to. Step by step Mr. Cheshire had traced this disease, and he had shown that it was analogous to very many diseases which affected not only animals but human beings. Indeed, from our present standing-point of knowledge, every infectious disease was due to some organism, generally one of these *bacilli ;* and Mr. Cheshire had succeeded in adding one more to the already long list of infectious agents. With regard to the use of antiseptic substances, of which phenol was one, in food, he could see no real objection to the addition to food of either salicylic acid or phenol in small quantities, neither of them would have any injurious effect ; an argument against the use of antiseptics was that they were added to perishable substances to hide incipient decomposition, and of course they did not want such articles to be kept longer than they ought to be kept or would naturally keep. They wanted to have milk fresh from the cow, and not kept fresh by means of salicylic acid; and they wanted wine properly fermented and not kept. He quite agreed with Mr. Cheshire that when phenol was used as a curative it should be used pure. If the impure phenol were used, it would bring Mr. Cheshire's process into discredit on account of its variable effect and objectionable odour, which did not really belong to it at all, phenol being rather pleasant than otherwise, and that would be a test of whether it was pure or not. Only a pure substance, on which reliance could be placed, should be used for these purposes. There were very many other antiseptics which might be applied, like boracic acid, salicylic acid, and thymol; but phenol was the most powerful substance of its class. Many antiseptic agents were so poisonous that they could not be used with safety. He would only add an expression of his thanks personally to Mr. Cheshire for the very valuable and interesting paper he had given them.

The Rev. GEO. RAYNOR said the subject brought before them by Mr. Cheshire was one of the very greatest importance. Although he had been a bee-keeper for many years he never had a single case of foul brood—at least, to his knowledge; but certainly some doubts had occurred to his mind during the reading of the paper as to whether two cases which he had had a short time ago of bees dying in an unaccountable manner had not arisen from that cause. The manner in which Mr. Cheshire had laid the matter before them could not be too highly spoken of, and he hoped they would hear something from gentlemen present who had more experience in the matter than himself.

Mr. GRIFFIN (Secretary of the Devonshire Bee-keepers' Association) said that in the spring he had had to destroy nine stocks on account of foul brood, fearing it would spread to the neighbouring apiaries; and, having been away from Exeter most of the spring, he was unable to thoroughly test the remedy of salicylic acid, as recommended by Mr. Cowan; he also stated that the smell from the diseased stocks was very bad. Another stock showed slight signs of the disease, and being very strong with bees, he put a super upon them, and for three weeks after the smell from this stock was most offensive, and could be detected some considerable distance off. In six weeks he found that the smell was entirely gone, and that the section tray had been filled with fifty pounds of honey. He had not since examined the stock to see if the foul brood had disappeared. However, that was a very curious circumstance, which, perhaps, Mr. Cheshire would explain. In several of the stocks the bees had been trying to raise queen-cells ; the queen-cells were there, but the bees were evidently not strong enough to throw off a swarm ; some had wings and had died before they were nearly hatched, and some were dying in the cells. These circumstances seemed to point to the fact that something was evidently amiss with the queens, and that the bees were aware of this, and were trying their best to remedy the evil. A gentleman told him lately that a cottager had been trying blue gum, by putting a few drops into the hive, and he said that the foul brood disappeared in a very short time, probably from the vapour arising from the gum.

Mr. T.B. BLOW would be glad to hear whether Mr. Cheshire had tried the effect of thymol for foul brood. He had never been troubled with that disease, but he had tried experiments during the past two years with bees subject to the disease, and had found that thymol proved an almost perfect remedy when administered in food and also in the hive. He supposed the action of thymol would be extremely similar to the action of phenol, but of course he had not gone into the matter in the same scientific manner as Mr. Cheshire had done.

Mr. LYON was able to inform the meeting that the "blue gum," referred to by Mr. Griffin, was the oil of eucalyptus or blue gum tree. There was a substance termed "eucalyptol," extracted from this oil, which was a parallel substance to "thymol." In the Exhibition building Mr. Squire had very kindly shown him samples of both. They were crystalline substances similar to camphor, with a very similar smell, and no doubt their properties were also similar.

Mr. JESSE GARRATT (Secretary of the Kent Association), in confirmation of what had been said by Mr. Griffin, said that he had also found bees in diseased hives raising a great quantity of queen-cells.

The Rev. F. T. SCOTT might say, with the rest of the speakers, that he was exceedingly interested in the paper which Mr. Cheshire had read to them. If it proved successful the remedy would be a very great boon to apiarians. He could not say with Mr. Raynor that he had never suffered from foul brood, but he had certainly never discovered it until last year, when he attributed it to the introduction of a Ligurian queen into his apiary. He found that two or three stocks had afterwards become affected with foul brood, and he was obliged to destroy them ; but two stocks infected with disease were so strong in bees that he determined to leave them, removing the queen from one and left the queen in the others. Those two stocks had prospered this year. The bees had increased very rapidly, and had given him one or two very good supers, but on examination the other day he found there were still some infection and symptoms of disease, and he was very anxious to know how to treat it. His idea was that they must be destroyed, although he found that Dzierzow, the great German apiarian, did not fear the disease, having cured it with carbolic acid ; while the great Dr. Langstroh, the American apiarian, said that though the disease was checked in the autumn it re-appeared in the summer.

The CHAIRMAN said that several gentlemen who had spoken had stated that they had never been troubled with foul brood ; as the meeting had heard a great deal about a cure of the disease he would like to hear from some of the victims of foul brood to what extent they had suffered from it. He saw Mr. Martin present, whose letter he had read to them, and would be glad if he would kindly stand up and say what he had suffered from foul brood. The meeting would then be better able to judge of the importance of the cure. Mr. Martin had long ago been guaranteed, by the British Association of Bee-keepers, to be the best sample of a *bonâ fide* cottage bee-keeper that they could find; and he lived in High Wycombe, a district which was sadly infected with the disease for which they were trying to find a remedy.

Mr. MARTIN said that about seven years ago he introduced Ligurian queens into his hives. He never knew what foul brood was until then. He had about ten queens, and introduced them into some of his best stocks. The older members of the Association might know that he used to exhibit splendid honey, but as soon as he introduced the Ligurian queens the very first year he was attacked with foul brood. It began in the spring. He could not make out why his bees did not prosper, and he examined the hives and found a very bad odour from them. He wrote to Mr. Cheshire and asked his opinion and advice, and that gentleman gave him to understand it was foul brood from the sample that he gave him. He watched the infected stock, and though it dwindled down to nothing, there was some splendid honey in it. He gave seven stocks honey from that one, and every one of them had it. Then it began to spread, and last year he lost forty stocks from foul brood. He cleared out the last one last summer. However, he persevered again and brought seventeen more from a distance last year which he brought to his apiary in the spring and he found there were about ten of them had caught it again. He moved seven of them about a fortnight ago, and took all the honey away. He had come to the meeting to try and see if there was a remedy, and if there was anything that could be tried he would like to avail himself of the opportunity of using it. He had with him a little piece of comb which he would be glad to show to the meeting, and he would send any quantity of comb, bees, or queens with foul brood that they wished at any time.

The CHAIRMAN said they would very much like to have some of the comb.

The Rev. F. S. SCLATER said that in Buckinghamshire they are seriously infected with this disease, and he could certainly speak personally from the condition of his own hives. Mr. Cheshire had given excellent directions for using syrup medicated with phenol in a frame-hive, but it did not appear so easy to give it to the bees in a skep-hive, remembering that they must put the syrup into the cells and not give it through a feeding-bottle. He would like to know whether Mr. Cheshire could suggest any means of introducing it successfully into skep-hives, where in many cases foul-brood was likely to exist undetected and without proper treatment. In this way the skep doubtless became in many instances a centre of infection, and its owner, in happy ignorance of the disease and its characteristics, might neither find out for himself nor allow others to ascertain for him what was causing his hives to do so badly. He thought it was most desirable that the British Bee-keepers' Association should publish a small leaflet, specially designed for the use of cottagers, whether members of the association or not, giving, in as plain words as possible, directions for using this new remedy of Mr. Cheshire's, telling them where the materials which they needed could be obtained, and giving them every information on the subject. If that sort of leaflet were circulated throughout the country they might get the old-fashioned skep-keepers to take the matter up and try thoroughly to get rid of the disease ; but unless energetic steps were taken soon he felt convinced that in many districts bee-keeping would decline very rapidly.

The Rev. E. BARTRUM said it did not seem quite clear to him that salicylic acid had proved a failure, and he would like to hear what Mr. Cheshire could tell them on the point. He regretted to say he had had foul brood, and far too much of it. On his first acquaintance with Mr. Cheshire he well remembered that gentleman coming to him full of the enthusiasm which still happily animated him. He had introduced salicylic acid and sprayed the combs, but whether the remedy corresponded with the result might be a doubtful question ; he would hardly like to say that, probably that would be unfair to him, but still he thought that the results of using salicylic acid were in many cases fairly satisfactory. Mr. Cheshire in his brilliant paper had shown that he had gone through the question very thoroughly, but still before the British Bee-keeper's Association undertook to publish any essay upon this question the subject should be more thoroughly investigated. Mr. Cowan had mentioned a paper in the letter put before them, a paper translated from the Russian, in which camphor was said to be an absolute specific. He hoped, in some form or other, the difference between those two substances would be pointed out to them, and why phenol should be so superior to camphor. If they could use camphor for this purpose it was quite clear they had only to put some camphor inside the hive, and they would have something which would at once prevent the disease. No doubt Mr. Cheshire would take up the point and give them some further information upon it. It was most important when they had their apiaries in a good condition not to buy driven bees. He felt convinced that he had introduced foul brood into his hives by purchasing driven bees in the autumn, and his advice to bee-keepers was not to purchase bees from outside unless they were sure of them, and to keep their stocks to themselves. If their stocks were quite free from infection they might then possibly escape the disease altogether.

Mr. HARVEYSON said that at Finchley he had cured a hive of driven bees by salicylic acid. Last autumn he found foul brood in it, and separated the queen until all the brood was hatched out ; he then uncapped all diseased cells and thoroughly sprayed the combs with salicylic acid, and the bees were now all right—though rather weak. About a fortnight ago he examined a hive for a friend at Finchley, and found it full of foul brood. He took a frame of it to Mr. Cheshire, who examined it, and gave him some of his remedy. He had found that by applying the remedy, as directed by Mr. Cheshire, the bees were rapidly clearing out the diseased cells, and in some there was already healthy-looking young brood. He might say that the frame which he took to Mr. Cheshire he had put into his own hive, which he cured last year, and there were no signs of the foul brood in the comb now.* He was sorry to say that there was a great deal of foul brood around his neighbourhood, and that the bee-keepers would be very pleased to get rid of it.

The Rev. Mr. WILKINSON had seen one bad case of a foul brood in a hive at Marlow, where the old plan had been adopted of isolating the bees and sprinkling the combs, and then returning them to the hives; but that was the only case which he had known of in his district in South Buckinghamshire. After what had been stated, he certainly would fight shy of driven bees. Among the large apiaries, those of Mr. Scott Murray, foul brood was perfectly absent, as it was in other cases where apiaries were kept by gentlemen in the district. He could not say what the effect of keeping bees in skeps was. He would like to have a prescription for the use of this phenol remedy. With regard to the case he had mentioned, the man of whom he had spoken had scarcely any honey in comparison with what he had had in former years, although he lived in the best district possible for producing it, the fields at the back of his house being a mass of bloom.

Mr. ATHAWES remarked that it should not go forth from the meeting that people ought not to buy driven bees, because if they had a cheap and easy cure, why should they not be bought? Mr. Bartrum seemed to adopt a foregone conclusion that it was incurable, but if it was curable, there was no objection surely to buying driven bees.

Mr. DUNMAN (Secretary to the Dorsetshire Bee-keepers' Association) said he had only attended to learn the way to cure foul brood should it appear in his district, but he had not yet heard of a case of the kind. If cottagers were to be told they were not to purchase driven bees, and that those were condemned bees, the cottagers would immediately destroy them, and it would be the worst possible thing to go forth from that meeting that people were not to purchase or use condemned bees.

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* The piece of comb containing brood in perfectly healthy condition was handed to the Chairman.

Mr. MARTIN wished to know, from something which had been said, whether any objection had been intended to be made to the use of straw skeps.

The CHAIRMAN said not at all. Mr. Sclater had only asked whether the remedy could be as easily applied in them as in bar-frame hives.

Mr. MARTIN was sorry if he had understood the matter wrongly, but he would only say that he had found the bar-frame hives were as susceptible to the disease as straw-cap hives. He could refer to several cases where apiaries had been destroyed in which bar-frame hives were used.

The CHAIRMAN said the question was not in the least as to the relative merits of bar-frame or straw-skep hives; what they wanted to find was a remedy for the disease, whatever sort of hive it might attack.

A VISITOR was not desirous of saying a word against straw-skep hives, but he could state that in his neighbourhood one case had been distinctly and thoroughly traced to the use of them.

Mr. BULLER, with regard to the reference which had been made about driven bees not being purchased by bee-keepers, said that during the last two years Mr. Blow and himself had, he believed, introduced 500 lots of driven bees into hives, and never once had they had a case of foul brood, though the bees had been brought from all parts of the country. Many others—of course not driven bees—were from Italy, Carniola, Cyprus, Syria, and America, and all with same result—no foul brood.

The Rev. GEORGE RAYNOR would make the additional remark to what he had said before, that it struck him one of the most important points in Mr. Cheshire's paper was the possibility, or rather the fact, of imported queens introducing the disease of foul brood. He had always believed that it could not possibly be introduced by queens. For twenty years he had introduced imported queens, and he never had a case of foul brood, although two years ago he introduced about seventy imported queens. It had occurred to him whether his immunity from this terrible disease had not arisen from the application of the very remedy which Mr. Cheshire advocated, because he had always used, in preference to smoke, a weak solution of carbolic acid for quieting his bees. He never opened a hive without using it. With a long goose quill he moistened the tops of the frames with it, and the bees ran down, dreading it quite as much as they did smoke. He was very careful not to disturb them more than necessary, and he thought the remedy was much preferable to smoke, because it did not produce confusion or disturbance to the same extent in the hive. When he had spare combs stored away for the winter, ready for use in the next summer, he always sprayed them with a weak solution of carbolic acid, and he had at times, of late years, used in the food of the bees the salicylic acid solution, as described in Mr. Cowan's recipe. It was very probable that his immunity had arisen from his application of these two remedies, for although he had been in neighbourhoods where foul brood had existed around him, he never had a case of it himself. With regard to driven bees, he had very often strengthened weak colonies by their means, having added from twenty to thirty stocks every autumn ; and he found that he had never introduced foul brood by so doing.

Mr. J. M. HOOKER had suffered considerably from foul brood, but he was happy to say his apiary was now entirely free from it. Mr. Cheshire had mentioned his name as having visited the experimental hive at Acton. He was requested by some members of the Committee to inspect that hive, and to express an opinion as to whether it was a fair specimen of foul brood or not, and he could distinctly say that the hive had been clearly suffering from foul brood, as there were several frames in which there were foul-broody cells. He could say that it was going on very well at that time. He marked the frames which had still to be dealt with, and no doubt he should see presently that they had been entirely cured.

Mr. CHESHIRE said they were now all right.

The Rev. F. G. JENYNS said if he understood Mr. Cheshire's paper rightly, the only cure for this disease was that which he had given administered through the food; but if the only cure for it was by the food given to the bees, he could not quite understand how they heard from time to time of isolated cases arising in apiaries and yet being cured without that food being given. They had heard of fumigation and the use of camphor as remedies, but he did not understand at all how they could be remedies if the only remedy was to be administered through the food. He thought Mr. Cheshire's theory was excellent, and no doubt it was the true remedy, but he could not understand how those other theories could have had any foundation at all if Mr. Cheshire was right. They had heard about the queen bees introducing the disease, but of this he himself was no judge, having never introduced them. He kept to his own, and had never taken imported queens. Nobody, however, had had more experience than his neighbour, Mr. Blow, in imported queens, and his apiaries were quite free from disease.

Mr. HENDERSON said it was very possible that what had been read and said in that International Exhibition Conference would be translated into the journals of other countries, and they ought not to let any wrong impression go forth. Mr. Cheshire had mentioned the name of Mr. Sproule as having communicated to him the properties of phenol, but if they consulted one of the numbers of the *British Bee Journal* in the year 1876, they would find there the means adopted by Italian bee-keepers for the cure of foul brood. The Italian apiarians were in the habit of curing this disease by the use of three different kinds of acids—salicylic acid, hypermanganic acid, and phenic or carbolic acid. This was the means adopted by two distinguished apiarians, Signor Grassi and Dr. Dubini, and in a meeting of that kind it was desirable to know the previous use of phenic acid for these purposes by others, and to whom it was but just to ascribe whatever honour was due to them.

The CHAIRMAN observed that the Italians might say that, but they had apparently not applied the remedy. However, in order that the meeting might not separate quite as ignorant on this particular matter as when they came into the room, he would ask Mr. Hehner to point out to them exactly the difference between salicylic and phenol, and those other remedies which had been suggested ; that was to say, where they agreed and where they differed, in as simple and untechnical a form as possible.

Mr. OTTO HEHNER was very loath to deliver a chemical lecture, but he would simply say that all the substances mentioned—phenol, salicine, cresol, camphor, and eucalyptol—were all parts of the same big family. They were, in fact, very closely related to each other. All volatile oils on which the odours of plants depended had practically the same composition, consisting of the two elements, carbon and hydrogen, and a few of them oxygen. Chemically, there was no difference between them as far as the percentage of quantities was concerned, but they had different properties. Most volatile oils were chemically what were called turpentines. From those were derived the camphors. Of all camphor was the very weakest. It had the least action of all antiseptic agents. It was not likely to poison any animal, but it was certainly very little likely to do any good. Of all the substances carbolic acid was the strongest, and phenol and phenic acid were synonymous terms for the same thing, except that carbolic acid was generally taken to denote the impure article in this country, and phenol the pure substance, phenic acid being simply the expression used on the Continent for phenol. Between those two extremes, camphor on the one hand and phenol on the other, one representing the least active and the other the most active of these antiseptics, there were all possible gradations. People were anxious to have pleasant antiseptics, and they therefore liked to have thyme and eucalyptic preparations, but they were all less antiseptic than phenol. The chemical difference was very small, but they acted nearly all in this way, that when brought together with the juices contained in any animal, or in a plant, they combined with the albumen, congealing it, so to speak. Those antiseptics which had been mentioned might be divided into two classes ; part of them were volatile and were taken into the lungs through the air, and part of them, like salicylic acid, could not be disseminated through the air by any ordinary means, but must be taken in by the blood. Still it came to the same thing. If a substance was taken in by the lungs, it could only be taken in by small quantities at a time, and when it was taken in by the stomach it might be in larger quantities, but it was the same thing ; it was brought into the blood and into contact with the albuminous substance, which would be congealed by it and the cell killed. Permanganic acid acted in a different way ; that simply gave the oxygen it contained to whatever substance it met, whether it be animal or vegetable, dead or alive ; whatever it was it oxydised and destroyed it, and it was, therefore, a very injudicious substance to use, because it made no discrimination at all. Mr. Cheshire had therefore, he thought, picked out the most powerful antiseptic which could be used ; it was the most useful and the most likely to have the desired effect. Of course, an infinity of others might be used which all acted in the same direction upon contagion of all varieties ; but phenol was the embodiment of what an antiseptic substance ought to be.

Mr. MILLS said he had supplied Mr. Cheshire with a hive, and after listening to what had been stated at the meeting, it occurred to him that the record of that hive might answer some of the queries which had probably occurred to the minds of gentlemen present. His record of the hive went back to 1882, and since that time it had not had any addition of driven bees, nor had it had a queen introduced, and it had been a very prosperous hive through the whole of that period until the 2nd June last. Its first evidence of slackening power was noticed when dividing a swarm from it. He made a swarm which did not seem to do well, and the frames were returned to the hive, and his opinion was that this foul brood was very manifest on the 10th June, when the queen was pinched. On the 21st it was taken to Mr. Cheshire. Ligurian queen-cells had been inserted, but proved not to contain anything but the putrid remains of a queen grub.

Mr. CHESHIRE asked for the indulgence of the meeting if he should be somewhat disconnected in his replies, because of necessity the criticisms had gone all over the ground, and he must endeavour to run after them and catch them up as best he could. The part of the paper which unfolded the nature of the disease, and exposed the numerous errors that had obtained with regard to it, and which perhaps might bear the largest amount of fruit hereafter, had hardly been noticed at all; but no one could form any notion of the enormous amount of labour which he had had in elucidating that problem, which had altogether baffled bee-keepers up to the time he undertook it. However, taking the question of the treatment of the disease—with regard to the gum of the eucalyptus tree, the blue gum, Mr. Hehner had already answered the question so admirably that there would be no necessity for him to reply to it. In arguing with reference to the cure of foul brood there were two points which required careful consideration. First of all, the actual existence of the disease should be indubitably verified. How was it known that the instances referred to, which seemed to cure themselves, were really foul brood? There were appearances like foul brood which were not foul brood at all. He might mention the case of a well-educated bee-keeper sending him a specimen of what he called foul brood from Ireland, saying that he was very anxious about it, finding his hives to be suffering badly from that disease. Well, he examined it, and found not the slightest indication of foul brood. He would say that nineteen persons out of twenty of the knowing ones would have looked at the comb sent and have said it was undoubtedly foul brood, and yet it contained no trace of it. It was nothing but putrid and chilled brood, but the difference to the unaided eye was so small between that and foul brood that they could not distinguish it unless they saw it under the microscope. He had specimens of both substances mounted as microscopic objects, and it would be seen that thus examined the two could no more be mistaken for each other than a loaf of bread could be mistaken for a leg of mutton. Those gentlemen who had spoken might be right or wrong in their ideas about what it was that was troubling them, but unless they sent the specimens to himself or some person who was capable of deciding the point, and distinguishing whether they were cases of foul brood or not he would not like to say anything about them at all, as all debate would be but wasted time, the premises being uncertain. Then it was said that the disease was sometimes cured naturally. There was the *spirea ulmaria*, or the common meadow-sweet, from which the bees gathered honey, and thereby carried salicylic acid—which is naturally secreted by this plant—home to the hive in the best possible form in which it could be got; so that they had the remedy given to them by nature in the blooms of the flowers from which they gathered. As to why in diseased hives queen-cells were so often raised, he could hardly as yet give an answer which could be considered as more than very probably correct, as at present it must rest upon theoretical grounds rather than actual observation. It was not possible for him as a single individual to gather all the material which was essential, but he took it that the explanation was this: the queen had the disease, and the bees being aware of it, attempted to displace her by raising a new one, and their queen-cells were almost always found to be abortive. Some important bee-keepers present were ladies, and he asked them and the gentlemen who kept bees kindly to assist him in this direction by sending him from hives behaving in the manner under consideration such queens as they could spare, and he would then probably have the opportunity of spotting a queen which had the disease. He had spotted drones and workers which had it, and he had not the slightest doubt in the world that the queens might have it too. From induction it seemed certain that it was so. Then in all germ diseases there were cycles of greater or less activity, and there might be an attack of the disease in its less active spore condition, and possibly then it might, other things being favourable, disappear without assistance, but he very gravely doubted it. He had mounted some of the foul-brood matter and some of the baccilli, and the meeting would see that there were very robust specimens from a southern county. Mr. Martin had told them that he had lost £30 by his bees, and no doubt they would all heartily sympathise with him; but he knew of one bee-keeper who had lost this spring more than £200 in bees alone. That was certainly a very considerable trial, and he had known of other cases like it. Then he had been asked whether salicylic acid was a failure as a remedy for this disease, and to that he would answer, No. It had been part of his work to assert, on more than one occasion, that salicylic acid was a cure, and he had stood almost alone, shoulder to shoulder with Mr. Cowan, defending the position of salicylic acid years ago. But what he said was that directly they associated salicylic acid with borax, they reduced its curative agency. He was certain of that, and directly they put into the hands of uneducated persons a remedy which they were to use as a spray, they did mischief, because such persons went on spraying and spraying until they killed everything. The continued mortality amongst the grubs was supposed to be evidence that the disease was still active, while in fact the larvæ were dying of the doctor. His microscopic discoveries had for the first time made it possible to lay bare this fallacy. As Mr. Hehner had put before them, he did not think salicylic acid was to be compared with phenol. He had cured lots of stocks with salicylic in the past, but he would no more think of doing so now than he would attempt to swim across the channel instead of taking a steamer. Such an easy way of curing foul brood as this being announced, surely everybody ought to take it up. Then with regard to the question of skeps, there they were on tender ground. He was not a *skepist*, and he was very glad of it, for if he had been he would not have seen so much of bees as he had done; but in spite of the strong feeling on the part of some persons in favour of skeps, a skep was not, after all, a hive in half the senses that word ought to be used in these days, and it was in these skeps that the disease lurked. While the cottagers were in their present state of feeling with regard to skeps, the Association must be content to suggest the use of phenol. Salicylic acid was difficult to use, and they had to go through a good many processes before using it; but they could, on the other hand, take a definite quantity of phenol, put it into a measure of water, and add the required quantity of the solution to each pint or quart of syrup, and make a pint of syrup, and there was the whole thing in a nutshell. Ignorance, of course, ought to be discouraged, but if those Italian gentlemen who had been mentioned had found a remedy so long ago, how was it that they were still suffering so much from the disease? and how was it we had suffered so much from it? He thought, therefore, if they had suggested phenol, they had never suggested the way of applying it, nor the proper proportion of it. That was probably the reason that so little had been heard about it, and he claimed for himself the discovery of the way of applying the remedy and its amount. If the remedy was applied in his way, foul brood would give them no more trouble. He might illustrate his meaning by saying that if he were a bee-keeper, depending for his living upon selling his honey and bees, and possessing say 100 stocks, it would actually pay him to allow for the sum of 2*s.* per stock a frame of comb in the very worst condition from disease to be put into each. Treatment would quickly make all sound and every colony would be considerably strengthened by the process. They had the very important evidence of Mr. Raynor with regard to his using a small quantity of phenol, and his possible immunity from disease in consequence of that. Well, that was very likely. He was not going to run down Italian queens; on the contrary, he had a great belief in them; but he had a greater belief in Italian queens that were raised at home, and he could say that they were far finer queens than they could ever get by importation. He had never said that those queens had introduced the disease, but he felt all but positive upon the point; and he was very sure that those who said that they had been the means of introducing foul brood into their apiaries had spoken in good faith, and had scientific evidence behind them which said that they must be right. He would like them all to go away resolved to turn over a new leaf, and not to advise every poor man to burn his combs and hives and get rid of them. That was simply saying to a poor man that he must look ruin in the face at once. They had a remedy, he would state fearlessly, which, if put into that man's hands, with a little kindly help from his, perhaps, better educated neighbour, would rid him of the disease without touching a bit of comb, and without unqueening a stock. If they did that they would do that man an enormous service, and help apiculture in this country. He hoped, therefore, they would all go away from the Conference with the resolution not to countenance the abominable system of wholesale destruction any longer in any case which came under their notice, or in any periodical in this country. To that end he had laboured. He had destroyed numbers of his own bees in experiment that the truth might be learned; but he should not regret them in the least if they had accomplished the object for which they had been sacrificed. There were bee-keepers now who had the disease raging in the most terrible manner in their apiaries, and if they allowed it to go on it would be shameful, and they would be the means of making their poorer neighbours suffer much more than they had ever suffered before. In conclusion, he thanked the meeting for the patient hearing they had afforded him, and hoped that some good result would come out of the discussion, so that very many bees might be saved, and very many bee-keepers as well.

The CHAIRMAN proposed a hearty vote of thanks to Mr. Cheshire for his able paper, and for the remarks he had made in answer to the observations addressed from the meeting. That the subject was a most important one they could easily imagine when they heard of one man losing £200, though, perhaps, he might be better able to afford the loss than the poor cottager who had lost £30 by his bees. It was a miracle that any bees should have escaped at all after what they had heard. It seemed that the queen might give it to the bees, or they might get it from the flowers, where it had been left by the legs and antennæ of the bees who had been there before. There was one comfort, at all events, and that was that nature furnished the bees with a remedy in *spirea ulmaria*, which supplied them with salicylic acid in its best form for them. They could hardly, perhaps, appreciate the labour by which Mr. Cheshire had arrived at the results he had reached ; but undoubtedly Mr. Cheshire had marked out a new path in the history of apiculture. He had not heard anything before that day of this *bacillus alvei* to which he was to be godfather ; it seemed, however, that it would be his duty not to bring it up carefully, but to hunt it out and destroy it. If this *bacillus alvei* were the cause of this disease, as *bacilli* were the cause of cholera in human beings, and of glanders in horses, they would see how terrible an enemy it was. Mr. Cheshire had opened out a wide field of research, and he thought that a good many people besides bee-keepers would do well to profit by his labours. However, they had only to deal with the *bacillus alvei* at present, and their thanks were due to Mr. Cheshire for having directed their attention to this noxious pest, and for pointing out the remedy they should employ against it. It seemed to be the general concensus of opinion in the meeting that phenol was the best remedy to employ, and more likely to be efficacious than any other remedy. He hoped they would meet together to-morrow to discuss the subject of adulteration of honey, and how it might be counteracted, and that they would then and subsequently hear the results of the experience of gentlemen who had tried that remedy.

The Rev. V. H. MOYLE, as a bee-keeper, who had had considerable experience of foul brood, had great pleasure in seconding the resolution, and also in thanking Mr. Hehner for his very instructive remarks.

Mr. CHESHIRE, in returning thanks, earnestly invited the members and friends present to communicate with him on the subject, and to afford him any information in their power.

CONFERENCE ON SATURDAY, JULY 26, 1884.

The Rev. HERBERT R. PEEL, M.A., in the chair.

THE CHAIRMAN announced that the subject of the paper to-day was the Adulteration of Honey, and he need scarcely say it was hardly less important than that which they had discussed yesterday. He had then read part of a letter from Mr. Cowan, and in the second portion, which he had reserved for this occasion, the gentleman said, "The adulteration of honey is also an important subject, and I hope Mr. Hehner will show that the materials left in glucose during its manufacture are such as to be injurious to health. I can understand glucose prepared in a laboratory being pure, but that manufactured commercially is never pure and contains an excess of lime or sulphuric acid." Mr. Cowan then went on to say, "I hope something may be done to replace the adulterated specimens at the Exhibition, so that the public may know how to recognise the good from the false." He must say that the Council of the International Health Exhibition, though it had invited them to discuss the subject of adulteration of honey, had certainly not assisted them in bringing the actual fact that honey was adulterated before the public notice. They had had a case fitted up filled with specimens of honey which had been purchased in the open market and submitted to an analyst for testing; but that case had been removed by the Council of the International Health Exhibition, for some wise and inscrutable reason of their own, doubtless possibly thinking that those adulterations should be allowed to live in the order of nature for the same reason that such animalcules as the *bacilli alvei* were allowed to exist in her economy. Mr. Cowan had alluded to the "manufacture of glucose." Of course he (the

Chairman) knew some time ago that glucose might be manufactured out of old rags, and he was in fact told that an extensive manufactory of the kind was in existence in the neighbourhood of London, but he was not aware until yesterday that glucose was also manufactured out of old disused pawntickets. In former days they were told that there was some process of renewal of the skin constantly going on, and that it was supposed to be entirely renewed in every seven years, so that during that period people might possibly eat their bakers; but it seemed to him that a new sort of cannibalism was now introduced, and that in consuming this glucose, in addition to eating their bakers in seven years, they might also eat their "uncle." However, the Conference would have the effect of bringing before the public the fact that honey was adulterated, and that the only safeguard they had against consuming adulterated honey, which might very possibly be injurious to health, was the efforts that were being made by an association like that of the British Bee-keepers in that direction, the result of which would give a guarantee that the substance sold as honey was pure. Without further preface, he would ask Mr. Hehner to read his lecture.

ADULTERATION OF HONEY.

By OTTO HEHNER, F.C.S.

FROM time immemorial the activity of the honey-bee has attracted the attention and received the admiration of man. The industry of the insect, its well-directed ingenuity, the deliciousness of its product, and the marvellous order of its gregarious habit, secured it a unique position in the immensity of animal creation. And although, with the advance of knowledge, we have recognised that there exist in nature many other equally wonderful and far grander instances of vast results produced by the co-operation of individuals insignificant in themselves—that, indeed, a great portion of the surface of our globe owes its present structure to the united efforts of countless numbers of creatures, partly of microscopical dimensions, and that the smallest conceivable living cells are the masters and destroyers of all life; yet, even now, the bee receives as large a share of admiration as ever. And with all our advances and improvements in every department of life, now, as of old, honey and milk are still the embodiment of all that is delicious and desirable in food.

In this age of butter innocent of contact with the cow; of wine devoid of grape-juice; of beer without malt and hops; of coffee-berries made in a mould and not grown on a tree; and, if report can be trusted, of eggs not laid by the hen; can it be wondered at that honey has received a due share of the attention of semi-scientific imitators and improvers of Nature? "Delicious table-honey," and "prepared honey-dew," made in one of many ways, not in a bee-hive but in a factory, is a common article of commerce; and poor *Apis mellifera* has had notice that its services will no longer be required.

To teach you how to make honey, and to enable you to distinguish your product of manufacture from that of the bee, is the object of this lecture.

There exists a very large and characteristic class of organic substances, mainly products of vegetable life, which consist of the three elements—carbon, hydrogen, and oxygen; and as there are for every one part of hydrogen eight parts of oxygen in these substances—which is precisely the same proportion in which these two elements unite to form water—the class of matter alluded to is called that of *Carbohydrates*. When direct or diffused sunlight shines upon a green leaf, that leaf is stimulated into activity; it abstracts from the air the gas called carbonic acid, but forthwith restores to the atmosphere the oxygen contained in the carbonic acid and retains the carbon.

This, directly or indirectly, unites with the moisture contained in the leaf, and the result is the most important of all carbohydrates—namely, *Starch.* Every four parts of carbon thus combine with five of water. The starch thus formed at first deposits in the leaf-cell in which it took its origin. The circulatory juices of the plant, however, gradually dissolve it and carry it throughout the whole system, either to deposit it again wherever it is wanted, or to transform it into other products. Thus in cereals, like wheat, oat, rice, or maize, the deposition takes place in the seed itself; in the potato, in the tuber; in the sago-palm, in the pith of the tree; the accumulated deposit being intended either as food for the growing germ or as a store for the plant to fall back upon in early spring, when under the influence of light and heat the juices begin to show activity, but when as yet no leaf has made its appearance capable of taking its food from the air. One of the most characteristic distinctions between plants and animals is the power inherent to the former of building up their structure from compounds of great simplicity, such as carbonic acid and ammonia and water, whilst the animal is essentially a destructive creature, breaking up the plant-material into its original simple derivatives. But only when the plant has become *green,* when its cells have deposited that mysterious substance called *Chlorophyll,* its constructive capacity is established. Plants habitually devoid of chlorophyll, such as the fungi, and some parasites, are essentially animal in their nature: they destroy, but do not construct. Each plant, then, which has green parts, contains starch, formed in the leaf; a potato, paradoxical as it may at first sight appear, does not grow in the soil, but in the leaf of the plant; an ear of wheat or of maize, not on the summit of the stem but in the foliage. The starch thus deposited in one part of the plant or other generally congregates in minute granules, more or less rounded, and the shape and size of the granule is invariably characteristic of the plant: a glance through the microscope enables the practised observer to declare that this starch granule is one of the potato, that of wheat, or of sago, with just as much certainty as the unaided eye distinguishes between an apple and a pear, although the substance of both is essentially the same.

Starch, then, is the first and by far the most important of organic substances produced by the plant. From it multitudes of other vegetable products take their rise, constituting the greater portion of all plant structures. In order that this can be done, the starch once formed must be carried about by the sap of the plant into every cell, be it of the root or of the flower. Now as each cell is a delicate membranous bag closed in itself, it follows that solid substances such as starch owing to its insolubility in cold water would be, cannot circulate through the plant, and somehow or other the work of solution has to be accomplished. This process is best observed in the case of germinating starchy seeds, where comparatively large and compact stores of starch granules pass into solution in a short space of time. If to a considerable bulk of starch paste—such as results by the action of boiling water upon arrowroot or corn flour—a little crushed malt be added, the paste becomes liquid almost instantaneously. A cold infusion of malt acts equally vigorous, and when examined chemically is found to contain a small amount of a substance nearly related in composition to white of egg, called *Diastase;* and it is owing to the presence of this in malt, in all germinating seeds and active plant juices, that the solution of starch is effected. Of course, in the case of a growing plant we have raw starch, unsoftened by heating, and the process of solution is proportionately slower, but still it is essentially and in its results entirely the same.

The solution thus obtained is *devoid of starch;* it has become sticky and sweet, and contains two or three dissolved matters, one of a gummy nature called *Dextrine*, and a variety of sugar named *Maltose.*

The animal, appropriating the starch formed and stored by the plant for its food, has also, before it can utilise it, to bring it into solution, and for this purpose its saliva is furnished with a substance analogous to diastase, called *Ptyaline*, which acts equally rapidly and powerfully upon starch, especially boiled, the products of its action being also dextrine and maltose.

In an entirely chemical manner this solution of starch can likewise be readily effected, and, as will be seen further on, this chemical action is one of great importance to manufacturers of "fine, prepared table-honey." It consists simply in heating starch with acid, generally sulphuric. But the action is not quite identical. Dextrine and maltose are at first formed; but these, by the continued action of the acid, gradually disappear, their place being taken by a substance called *Dextroglucose*, or fruit sugar, because it is identical with that found in ripe grapes or other fruit. This is also a kind of sugar, but it contains a larger proportion of water than starch or dextrine; namely, for four parts of carbon, six parts of water.

This product has long been made on a very large manufacturing scale, and is known in the market under a variety of names,—saccharum, brewing sugar, and corn sugar. Its syrupy solution in water is called "corn syrup." It readily ferments when brought into contact with yeast, and yields the usual products of fermentation; namely, carbonic acid and alcohol. Hence its use for brewing. The outline of its manufacture is this:—Starch, water, and sulphuric acid, are heated together in a steam-boiler; the fluid thus obtained is mixed with chalk, which neutralises, and to a great extent removes the acid, and the clarified solution is then boiled down, either to syrup form or until the solid sugar remains behind.

But allow me to follow a little further the changes which take place in the plant after its diastatic sap has dissolved the starch. From the solution every minute cell abstracts a portion of the sugar and deposits it in the form of *cellulose*, or woody fibre, which forms the framework—the skeleton, as it were—of every plant. It has chemically exactly the same composition, both qualitatively and quantitatively, as starch. Like this it can readily be converted into fruit or brewing sugar by the action of sulphuric acid. Every one has heard—generally somewhat incredulously—of sugar to be manufactured from old linen rags. This is, however, a perfectly feasible proposal, which could readily be carried out if the low price of starch did not render the employment of cellulose for the preparation of this kind of sugar unnecessary and unprofitable.

Another portion of the dissolved starch is changed by the plant into the sugar *par excellence*, *cane* sugar, which for 4 parts of carbon contains 5½ of water. In a few plants, as in the sugar-cane, the beet, or the maple, this is the principal product into which the starch is changed, and from these the enormous supply of cane sugar is derived; but all plants form more or less cane sugar, and secrete it by an apparatus connected with every flower, called the *nectary.* Now it is generally supposed that the nectary supplies to the bees visiting it the honey which we take from the hive. This is, however, not the case. The sweetness of most flowers is almost entirely, or in part, due to cane sugar; and honey, as I will show presently, is devoid of cane sugar. The bee abstracts this cane sugar from the flower. It passes through its body, and is there transformed into two other sugars, the one being *dextroglucose*, the identical glucose which results from the action of sulphuric acid upon starch; the other is called *Levoglucose*, or *Levulose*, a syrupy, exceedingly sweet sugar, of the same percentage composition as dextroglucose. The bee, therefore, must contain some principle allied to diastase which effects this change. This can also readily be brought about by the action of acid upon cane sugar, and a syrup is thus obtained consisting of dextro and levoglucose in equal proportions.

The amount of sugar thus secreted by flowers varies much. One fuchsia flower yields ·117 grains of sugar, five-sixths of which are cane sugar; one claytonia, ·006 grains, two-thirds of which are cane sugar; each flower of the garden-pea has ·153 grains of sugar, almost wholly consisting of one or both of the glucoses; vetch, ·002 grains per flower; red clover, the same amount. Now, seeing that each head of clover is made up of about 60 individual flowerets, 100 heads would yield 11·2 grains of sugar, and 62,500 heads would give 1 lb. avoirdupois of 7000 grains. To collect 1 lb. of sugar, therefore, sixty times 62,500 distinct flowers of clover would have to be deprived of their nectar, and 3,750,000 visits would be necessary. But as honey contains on the average only about 70 per cent. of sugar, a somewhat less number of visits, namely 2,625,000 would suffice for the production of 1 lb. of honey.

Through the kindness of a great number of members of the British Bee-keepers' Association, and others, I have been placed in possession of very many samples of honey of known derivation—of apple and fruit blossom, of may, limes, beans, heather, clover, sainfoin, cinquefoil, blackberry, and other honey-yielding flowers. I have very carefully examined them, and found every one to be free from cane sugar. Even when bees were fed upon cane sugar alone, yet the honey stored by them was devoid of that sugar. Honey, therefore, must be regarded in the light of a true secretion, and not as substance merely culled from flowers and stored in the comb.

The bulk of honey, then, consists of the two sugars which I have named, kept in solution by a quantity of water amounting to about one fifth of the total weight. This quantity of water is not quite sufficient to keep one of the sugars—the dextroglucose—permanently in solution, and gradually, therefore, this separates in a crystalline form, honey in consequence becoming in time opaque, and even solid. Genuine honey almost invariably undergoes this physical change; and although there are rare exceptions, a guarantee given with any sample of honey that it will remain permanently clear may be taken as a sure evidence of adulteration, either by the addition of water or of artificial syrup.

The proportion of water in honey is not a merely accidental one. Were more than one fifth part of water present in honey it would, in warm weather and in the normally high temperature obtaining in the bee-hive, be so fluid as to cause the honey to run out of the comb and to undergo fermentation. Water would also gradually evaporate. Were the amount of water smaller than that I have stated, honey would habitually crystallise and solidify in the comb, and in damp weather would attract moisture from the air. In honey, the happy medium just prevails. It neither loses nor appreciably attracts moisture, and in the comb remains perfectly transparent and clear for a considerable length of time.

Thus water, dextroglucose and levoglucose, constitute by far the greater bulk and weight of honey. But the bee carries away from the flower other constituents, less in quantity but by no means in importance, and incorporates them in the honey. Accidentally perhaps, but none the less invariably, a great number of pollen granules find their way into the comb, and these in their turn carry with it the odour and aroma peculiar to each flower. Minute amounts of colouring matters are dissolved from the pollen and give honeys from different flowers the innumerable shades of yellow, green, and brown, with which every bee-keeper is familiar. Thus honey from white clover is practically devoid of colour; that from sainfoin is yellow; from limes, more or less green; from beans, brown; from marshy heaths, almost black. Far greater still is the variety of flavours and odours. Every conceivable aroma, lovely and delicate as that of the flowers themselves—sometimes, I must acknowledge, also repulsive and unpleasant—is met with, and the practised observer can, without much difficulty, conclude from this from what kind of blossom the bulk of any given sample of honey is derived.

More characteristic still is the size and shape of the pollen. Infinite varieties, each characteristic of a particular genus or class of plant, can be seen in honey, and a glance through the microscope is frequently sufficient to ascertain with a great amount of accuracy the name of the plant from which the honey is derived.

From the very variable amount of pollen granules met with in different honeys—some samples which I have examined containing enormous numbers, others but very few—there appears to be a considerable difference in the degree of cleanliness with which bees store the honey. Some flowers yield an infinitely larger number of pollen granules than others, but the importation of the latter to a greater or less extent into the honey itself appears to me to depend mainly upon the bee itself.

There are three classes of manufactured honey: first, honey made from ordinary sugar, and essentially consisting of cane-sugar syrup; second, that obtained by the action of an acid upon cane sugar, and consisting, as does genuine honey, of water, dextro and levoglucose; and third, the product of the action of acid upon starch, called corn syrup. I have never met with any samples of the first of these three classes, and I doubt whether any such article can now-a-days be found, although in older works on adulteration their occurrence is asserted. The second kind is also very rare, but yet it exists; but the third, starch syrup, is the main substitute and adulterant used at the present time.

The characteristics of these articles compared with those of pure, natural honey, are as follows:—A solution of pure honey in water, when boiled with one of a salt of copper which has been rendered caustic by the addition of potash, deposits a precipitate of red sub-oxide of copper, 100 parts of honey thus yielding about 137 parts of precipitate. Neither by the addition of alcohol, nor of lead acetate, nor of barium chloride, should a solution of honey be rendered perceptibly turbid. Subjected to fermentation by the addition of yeast, practically the whole of the saccharine material should be decomposed, and transformed into alcohol and carbonic acid. And lastly, a ten-per-cent solution of pure honey, when examined in an instrument called a polariscope, should have no perceptible action upon polarised light. If anything, it may turn the polarised ray very slightly to the left.

Cane-sugar syrup agrees in its chemical behaviour with real honey, inasmuch as it does not yield precipitates with alcohol, salts of lead, or barium, and is also completely fermentable. It differs essentially from it, inasmuch as it does not give with the alkaline copper of solution alluded to a deposit of red suboxide at all, or only a much smaller proportion than that holding good with honey. Its ten-per-cent. solution turns the polarised ray of light powerfully to the right.

Cane-sugar which has, by treatment with an acid—sulphuric or tartaric—been made into dextro and levoglucose, is practically identical with honey sugar, and, as such, exhibits precisely the same characters as does genuine honey. Its origin, however, betrays itself by the traces of acid which always remain mixed with it, and which cause precipitates either with lead or barium solutions, or with both.

Corn or starch-syrup, lastly, differs in almost every respect from the genuine product. It throws down abundant precipitates with lead or barium solutions, often with alcohol ; it does not ferment completely, but leaves about one-fifth or one-sixth of its weight as unfermentable, gummy residue, and, examined by the polariscope, turns the ray of light powerfully to the right.

These few simple tests readily enable us to distinguish these products from each other, and from honey. Examined with the microscope they all are found to be devoid of pollen ; and, in consequence, are without the delicate aroma, the bouquet, which is inseparable from the product of the flower and the bee.

By far the most common of these kinds of adulterations is starch sugar, and this for several reasons. The price of starch is lower than that of any other available carbohydrate, and this kind of sugar is, for other and more legitimate purposes, manufactured on a very large scale. Since all restrictions on the preparation of ale or other so-called malt beverages have been done away with, and the tax is levied only on the strength or gravity of the liquor before it is fermented, it is found to be more economical to convert starch of rice or maize into fermentable sugar by means of acid, than by the aid of malt diastase, and the trade in brewing sugar has correspondingly increased. But the main reason is the very close resemblance to genuine honey of syrups made from starch sugar. They do not readily crystallise, and are devoid of the overpowering sweetness of cane sugar. In America, especially, the production of starch sugar has been developed to perfection, and even as a substitute and adulterant of cane-sugar the article is used to a large extent, although the very low price of cane-sugar must militate not a little against adulteration of any kind. As was to be expected, corn syrup is actually most frequently found in honeys imported from America, although Switzerland is striving hard to carry off the "honour" attached to the production of artificial honey.

Of forty-two samples of honey obtained by purchase from retail dealers, partly by myself, partly by Mr. J. M. Hooker, of the Bee-keepers' Association, twenty-six were avowedly English, nine American, four Swiss, two French, and one Transylvanian. Twenty-four of the English samples were undoubtedly genuine, and two (which I have very good reason to believe of American origin, although vended as English) were adulterated with corn syrup. Of the nine American and Californian samples, seven were adulterated, namely, six with corn syrup and one with inverted cane-sugar; whilst of the four Swiss samples not one was genuine. The two French and the Transylvanian samples were pure.

The most satisfactory part of these results is the freedom of English honeys from adulteration. As far as my experience goes, there exists no regular English factory of spurious honey; only where the American element asserts itself corn syrup may be expected. As to Swiss honey, I have seen it stated, in corroboration of my results, that every exporter—otherwise manufacturer—of Swiss honey adds to the natural product a more or less considerable quantity of starch syrup, the alleged philanthropical object being to obey the desire of the public for clear and uncrystallisable honey, purchasers being credited with the belief that pure and genuine honey is always clear and fluid. In mitigation, it is urged that honey from Switzerland is not sold as "genuine honey," but as "Swiss honey!"

I find that the price is no indication whatever of the genuineness of the article. Some of the "Swiss table honeys" cost, retail, 1*s.* 3*d.* per 1-lb. jar; English honey of perfect purity is to be met with at 5*d.* and 6*d.* per lb.

Of course, perfectly pure and genuine American and Swiss honeys do exist. Bees all over the world appear to secrete similar honey, just as I have ascertained, as the result of an extended investigation into the nature and composition of wax, that that product is of perfectly uniform composition, no matter by what kind of bees or in what part of the world it may have been produced. But seeing that the chances of obtaining pure honey are much greater in the case of English than in some of the foreign supplies which I have named, I cannot but think that lovers of honey would do well to eschew the foreign product until a decided change for the better has taken place in the commercial morality of the vendors, and be content with that gathered from British fields and pastures.

The adoption of anything but the plain name of honey carries to me, after the experience above detailed, the suspicion that the article designated by a name more or less qualified or fanciful is not genuine. Thus I have acquired, and hope to impart it to you, a suspicion against "honey-dew," "table honey," "prepared for table use," or "finest prepared table honey,', because I have found, that just as good wine needs no bush, so good honey needs no fancy name. These names and qualifications do not convey to the purchaser the simple plain fact that the article is adulterated. They may ease the manufacturer's elastic conscience, as disguised declarations that the honeys so designated are not in the same state as they left the hive. But I think they would not for a minute be held to be valid declarations, required by law, of the mixed nature of these compounds.

Chemistry during the last fifty—or shall I say thirty?—years has made enormous strides. It has enabled us to obtain a fairly clear insight into the working of life-processes, both vegetable and animal, to understand the composition of organic matters, and to trace their thousand-fold changes in living organisms. It has broken down the barriers which not so long ago were considered insurmountable, dividing the living from the dead creation. It has enabled us to make artificially, from the very elements, substances formerly intimately associated with life-action, and almost every day new organic substances are added to the already long list of those which are the result of laboratory work. But, so far, only chemical compounds of comparative simplicity have been the result, and in not a single case has any complex product, such as is used for food by man or beast, been obtained. Indeed, with all the enormous amount of research and experiment we only stand on the threshold of real knowledge of organic life ; we only see the rough outlines of the composition of living things. We know what the bulk of their components is made of, but in the case of food substances it happens that their value, and above all their price, generally stands in no direct relation to their composition. A cargo of manure or of some metallic ore possesses a value which bears a direct relation to the percentage of phosphoric acid or of metal which by analysis can be ascertained to be contained in it. A load of oil-cake or other cattle-food generally has both a feeding and a money value, directly proportioned to the amount of oil and of albuminous compounds which can be extracted from them. A water supply depends on quality strictly upon its composition. But the case is vastly different in that of most food materials used by man. Composition, as ascertainable by chemical analysis, goes for very little ; *quality*, which is dependent upon circumstances beyond the present ken of the chemist, goes for a great deal. Wine, for instance, consists essentially of dilute alcohol, slightly acid, and more or less coloured. But whilst a good bottle of wine may fetch—and be *worth*—say five, or ten, or more shillings, I have yet to taste the first sample of artificially coloured and dilute alcohol, slightly acid, which should be worth even a shilling per bottle. A pound of tea has no more food value than a pound of sloe or willow-leaves, but who would pay for the latter, say, three shillings, which the tea is readily worth? And so on with almost every article of food or of luxury. The value is not a question of the composition of the bulk of the article, but is regulated by the presence or absence of exceedingly minute amounts of flavouring matters, of which we know little or nothing at all. The difference between good and bad wine, or tea, or meat, is so small, that the most subtle analysis generally fails to detect it. And as in the case of these articles, so it is with honey. We prize honey, not because it consists of some sugar or other and water, but because it possesses a delicate flavour and aroma which is absent from, and cannot by any means at present known be given to, any artificially made syrup. Were the taste of the public educated for honey in anything like the same degree as it is for tea, wine, or other articles of every-day consumption, no one would venture to palm off artificial syrups for real honey. As well might a butcher offer his customers leather instead of meat, the composition of both being nearly identical.

It is possible that, as far as mere food value is concerned, the substitute is as good as the original article. Sugar, whether taken in the shape of cane sugar, starch sugar, or honey, produces the same proportion of heat and muscular energy. Butterine or oleomargarine, when burnt or digested, produces no less, if not more heat, than does butter. Yet butter holds its own against its substitutes, partly on account of its delicacy of flavour, and its much more ready digestibility. Some experiments recently made with starch-sugar syrup point towards a similar difference between it and honey, in favour of the natural product. Bees refuse, as long as they are able, to feed upon corn syrup; when driven by sheer necessity to take it, they soon die of diarrhœa. This fact should make us at least pause in giving a definite opinion as to the relative food values of the two products.

There can be no question that the Sale of Food and Drugs Act, at present in force, is as perfectly capable to operate against spurious honey as it is against other articles which are "not of the substance, nature, and quality demanded." But yet, as far as I am aware, it has never been put into motion against manufacturers of "honey." About 180,000 samples have been analysed by public analysts since the Act came in force, but I have not heard of a single prosecution in the case of spurious honey. It is not the fault of the analysts, who have absolutely nothing to do with the collection and purchase of samples. The growing evil of substituting a manufactured article for the genuine product presses especially heavy against the English producers, because the public seem to prefer honey derived nominally from fragrant alpine herbs, but practically from potatoes and sulphuric acid, or from some mythical Californian bee-farms, to that collected from English hedgerows and meadows. But this evil is not yet recognised by the general public; the taste for honey is not educated; any syrup is eaten as honey, provided it looks transparent and is contained in a neat bottle and boasts of a fine label. As soon as there is a demand for really good, delicately flavoured honey, and the Sale of Food Act is put into operation at the initiative of the public, corn syrup will be a thing of the past.

In order to aid in this desirable education of the public taste I would recommend that, whenever practicable, bee-keepers should state on the labels of the honey they sell from what kind of flower the bulk of the product is derived. Clover honey, lime honey, or heather honey, for instance, are quite as distinct in their characters as are Burgundy, Rhenish, or Mosel wines; but yet, while no one would purchase any wine without distinctly stating the specific variety which he desires, all kinds and sorts of honey are sold without any explanatory designation. Of course, from the nature of the article and its collection it is impossible, in many instances, to state its precise derivation, but whenever practicable this should be done. The British Bee-keepers' Association, which either directly or by means of its country branches has done so much to raise and encourage scientific bee-culture, could readily induce its members in this manner to aid in educating the consumers of honey. When fruit-blossom, lime, or bean honey is met with in commerce, perhaps manufacturers of the artificial article will possibly meet them in designating their product starch or cane-sugar honey. There can be no possible objection against the sale of these compounds, if they are only duly acknowledged to be artificial.

Not many months ago farmers had their attention directed by a gentleman high in authority to the advantages of fruit culture and the production of jams and other fruit preserves. In these times of agricultural depression every branch of industry which gives a chance of adding to the annual income must be carefully nursed and cultivated. A period has almost been reached when, in the agriculture of this country at least, these branch industries have risen to an importance greater than the original main occupation. Now is the time to study and to encourage the keeping of bees. With the pecuniary advantages, with the mental pleasure connected with it, I have now nothing to do ; others more qualified than myself, will not fail to present to you this side of the question. But if, by the matter which I have brought before you, I should in any way have contributed towards a largely increased production of English honey, I shall consider the result with the liveliest satisfaction.

DISCUSSION.

Mr. CHESHIRE thought they would all agree that the British Bee-keepers' Association ought to be very much congratulated on the fact that they had helping them in their work so able a gentleman as Mr. Otto Hehner. The ability of the paper had been apparent throughout, and another striking point in it was its eloquence and the accuracy of its English. Mr. Hehner occupied a very high position indeed in the chemical world, and they ought to listen with very great deference to everything he had to say to them. A very valuable book had lately been published on the subject of food adulteration, and if it did not actually bear Mr. Hehner's name it derived a great part of its value from his connection with it. This question was one which touched them very closely indeed, because British apiculture would be very heavily handicapped if it had to contend against foreign adulteration. They would have quite enough to do to contend against pure foreign honey. None of them could probably object to good honey being sent over to England from the Continent or America at a lower price even than English bee-keepers could sell it, because it would be helping, of course, towards the desirable end of introducing cheap food into the country. But when it was found that the foreign producers were sending us what was actually corn-syrup, while they were giving us to understand that they were supplying pure honey of a very good brand, British bee-keepers had reason to feel sore on the point, and therefore every thing they had heard on the subject from Mr. Hehner was very welcome indeed. The man who would label his pot "refined honey" when he knew it contained something which was not honey at all stood in a great measure by the side of the man who would sell the public some kind of oleo-margarine and call it refined butter. When the public were buying those things they might imagine they were buying some very special description of butter—something of very fine quality indeed; and they would be making the same kind of mistake in buying "refined honey." Mr. Hehner had shown them the advantage of the use of the microscope in connection with his investigations, and he had brought before them one notable fact as the result of them. He had stated that he had found some bees were more cleanly than others in the way in which they stored the honey in their hives, as he had ascertained that honey from some stocks was very much more contaminated with pollen granules than others. No doubt there were very great varieties amongst the different stocks of the same apiary; they had different habits and odd peculiarities running sometimes in directions against and sometimes in favour of producers and consumers of honey. There was one point which they should all think well out and try to act upon in managing their apiaries. In their endeavours to produce honey they were met with one difficulty in the propensity of the bees to swarm, and he thought that under their present system of management they were constantly increasing that propensity. When a hive swarmed it was furnished with queen-cells, and the mere fact that the bees had swarmed was *prima facie* evidence that the queen had a swarming disposition. These surplus cells would often be used for requeening stocks that had not swarmed naturally, and so the swarming tendency would be introduced where it had not previously existed in sufficient amount to cause a division of the colony; for the progeny would inherit the peculiarity of the queen, and therefore they would be likely to get from such hives bees which would swarm, whereas hives which had not that propensity, and which were giving the largest amount of honey possible, were hives from which they did not raise their queens, and from which, therefore, they would not get bees with that habit of swarming. Bee-keepers, therefore, should notice the hives which had the strongest propensity for storing honey and not for swarming. Naturally they would then be always raising queens from the swarming hives, and be thus by selection tending to increase the swarming propensity, whereas, philosophically, the very opposite course ought to be taken. If they could only get bee-keepers to look this matter well in the face, and strive by careful examination of their hives to raise in their apiaries bees with a less propensity to swarm and a greater disposition to store honey, they would get a larger number of storing hives in a very few years hence. By the aid of the microscope, Mr. Hehner said they could detect the sources from which bees obtained honey. He had recently discovered that, supposing a person well conversant with the microscope, and knowing exactly where to look, were provided with a piece of comb at this time of the year, with, say 20 cells, part of the foundation which had been put into the hive in the spring where there had been breeding and all the brood had hatched out, by the examination of that comb one could determine exactly the sources from which the whole of the honey in that hive had been obtained. It was very easy to understand, when one once got an inkling of the manner in which it was to be done. He had discovered some facts with regard to the intestinal canal of the larva which had not been previously known, and he had found that in casting their skin the contents of the intestinal canal escaped with the cast skin and were then stuck on the inside of the cell. How could that occur? The fact was that the contents of the intestinal canal acted as a sort of glue, which capillarity spread out, and those contents and the skin were held all together against the sides of the cell and out of the way of the moving chrysalis. If they got that skin out, they would find between the cast skin and the cell walls all the cellulose forming the pollen envelopes, and then by putting them under the microscope they could pretty well determine the plants from which those pollen grains came, and so ascertain the sources from which the honey had been gathered. The paper they had heard read was so exhaustive and complete that it really seemed there was nothing left for anybody to say except to thank Mr. Hehner for it, and to congratulate the Bee-keepers' Association upon having secured the valuable aid of that gentleman.

Mr. LYON said that after the scientific manner in which Mr. Cheshire had gone through Mr. Hehner's paper he had very few remarks to offer. One point, however, he would mention in regard to the direction in which they should proceed in this matter of the adulteration of honey. Mr. Hehner had informed them that the analysts had simply to analyse the samples given them by the inspectors, and the inspectors could not obtain those samples—at least, so he understood Mr. Hehner to say, until they received orders from the town or local authorities. But he thought they could put the whole train in motion in this way: that their local secretaries might worry the municipal authorities in their counties until they worried the inspectors, and the inspectors would in their turn worry the shopkeepers, and so samples of the adulterated honey would reach the county analysts. That, he thought, was a very good subject for the consideration of the county secretaries. In their own Bee Department at the Health Exhibition he had, not a fortnight ago, overheard a conversation between some ladies, who were suggesting that they should purchase some honey, and one of the ladies objected to buying English honey, preferring, as she said, to purchase Swiss honey. Why the public should like rubbish, as Mr. Hehner's paper had shown so much of the foreign honey really was, in preference to pure English honey, he did not know; it certainly showed a want of taste for the genuine production of the hive, and he therefore thought that every effort should be made to educate the public in some way in the matter, so that they should show a better taste in preferring our English honey.

Mr. DUNMAN quite agreed with what Mr. Hehner had said as to the great difference in cleanliness among bees. He had noticed that the Cyprians were certainly cleaner than our English bees in producing honey. There was a marked difference in their honey, particularly in the comb. Mr. Hehner had stated that by putting grape-sugar with honey it was kept from crystallising; but after our honey was once warmed it would not crystallise again, and he should like to know from Mr. Hehner what chemical effect that had on the honey. Mr. Gladstone had told the farmers, some time ago, that they should take to producing jam, and Mr. Hehner had now suggested that they should take to the cultivation of honey in this country; but, as a farmer, he could say that it would never pay farmers to set up large bee-farms for the sake of the profit they could get from them. It was, no doubt, a very good thing to encourage cottagers to add in that way to their incomes, but when they talked of extending it to the creation of bee-farms on a large scale in this country, he could only say that he did not think it would ever pay the farmers.

The CHAIRMAN invited observations from Mr. Blow on the subject, as having the management of a very large bee-farm at the present time.

Mr. BLOW thought Mr. Dunman had taken rather a wrong view of the bee-farming question, because it would go very well with Mr. Gladstone's advice to which he had alluded. Mr. Gladstone had recommended English farmers to go in for raising fruit jam, and if they wanted a large crop of fruit they must have bees to fertilise the flowers. On the farm with which he was connected Lord Sudeley had looked to a good return of fruit, rather than to a large crop of honey, but he had no doubt a good return of honey might also be looked for. That fact of bees acting as fertilisers to flowers should always be kept in mind by the English agriculturist. There was another point he would like to speak upon, and that was corn-syrup, to which Mr. Hehner had alluded, stating that it was impossible to produce corn-syrup perfectly free from traces of sulphuric acid. He would like to ask that gentleman whether it was not possible to produce on a commercial scale corn-syrup made with oxalic acid, the remaining traces of free oxalic acid being taken out with lime. Then with regard to the secretion of the honey, he would like to ask in what direction the honey dew turned the ray of polarised light.

The CHAIRMAN inquired whether Mr. Blow could tell them how many farms were laid down in Gloucestershire.

Mr. BLOW stated that about a year ago Lord Sudeley asked him whether he thought it was advisable to add a bee farm to his fruit farm. Lord Sudeley, about four years ago, had converted part of his heavy ground not suitable for other farming operations into a fruit farm of 100 to 200 acres, and it commenced immediately to give a return of strawberries and raspberries, and in addition to those fruits there were plum and other trees planted. That farm had increased in extent now to about 300 acres. He advised

Lord Sudeley that it would be desirable to put down a bee farm in connection with the fruit farm, even if it were only for the fertilisation of the flowers. Dr. Hooker corroborated his statement with regard to that, and Lord Sudeley decided to put down a bee farm. Between 270 and 300 stocks were now in existence, and as various other suitable places were being brought in 100 more stocks would, he believed, be put down during the forthcoming autumn. At present he could not say much for the result, because the bees had been there scarcely six months, but a fair yield of honey had been obtained, taking all the circumstances into consideration.

Mr. DUNMAN had not spoken with regard to the usefulness of bees in fertilising flowers ; he simply meant to point out that bee farming on a large scale, for the sake of the profit that could be got from it, would never pay the farmer in this uncertain climate.

The CHAIRMAN was glad to see present Mr. Moyle, who was very much interested in the honey market which had been established at Reading, and requested him to give his views on the production of honey in this country and its adulteration.

The Rev. V. H. MOYLE, after what had been said by Mr. Hehner and Mr. Cheshire, would not attempt to "gild refined gold," but would simply say that he had, in common with them all, derived a considerable amount of instruction from the lecture they had heard. He agreed with Mr. Hehner that they ought to do their utmost to increase the production and sale of genuine British honey. It was a painful fact that to a very large extent the taste of the British public at the present time preferred the foreign articles which were sold under the name of honey ; and when they remembered that the British Bee-keepers' Association had now for some years pursued its course, and was now surrounded by so many children in its county associations, and had been encouraging bee-keepers throughout the length and breadth of the land, they should endeavour to do something to deal with the question—

What was to be done with all the stores of honey which were being raised throughout the country? People could not be everlastingly eating bread and honey; something should be done to find markets for it, and therefore he thought this was a subject which came within the scope of their operations, and every member of every association should do their utmost in their several spheres to promote a better taste and a desire for the consumption of true honey among the British public, and to see whether fresh channels could not be opened for utilising the honey produced by bee-keepers. As a member of the Berkshire Society, he might say that he had frequently been met with the question, What were the people to do with their honey, as they could not dispose of it? That led him to endeavour to open a market for honey. He had spoken to Messrs. Huntley and Palmer on the subject, who had kindly interested themselves in it, and had thrown an amount of energy into the matter which could hardly have been expected, and they had produced for the market some honey-dew biscuits. The meeting would be invited to pass judgment upon their quality by-and-bye. He did not mean for a moment to suggest that anybody should buy up the honey at a cheap rate and sell it at a dear rate, and he did not want to interfere in the least with the market interests of any honey producers in this country, but he believed from the almost overwhelming mass of correspondence which was pouring in upon him every day that there were now very much larger stores of British honey in this country than there ever were before. He believed he could, if he wished, put his hands on 130 tons of pure honey. In asking for supplies of honey, before venturing to do so, he first of all asked for a sample 4 oz. bottle. In some instances those samples had been sent to the local analysts, and they might now hope, in case of any difficulty, to refer to Mr. Hehner as to a supreme court of final appeal. He might also say that he was hoping to open up, with the assistance of a friend or two, a depôt in London, one in Edinburgh, and one in Dublin. As he had already stated, he did not wish at all to trench upon the existing markets which any one had found for his or her honey. By all means let everybody sell their honey wherever and whenever they could get 1*l.* per hive for it—so much the better ; but there were districts in this country where, to a great extent, cottagers were beginning to ask themselves whether it was of any use, after all, their throwing their energies into bee keeping, and persevering with it at the risk of not being able to get a market for the sale of the honey which they raised. If, therefore, every member of the County Associations would do their best to influence local confectioners, or any manufacturers within whose province it might come to use honey in any shape or form, to set going the idea that English honey could be used more than it had hitherto been, which had been simply in the consumption of bread and honey, that would enable them to utilise the great stores of home honey which were now produced. He quite endorsed a remark which he had heard Mr. Baldwin make at Shrewsbury, that bee-keepers evinced disappointment because they could not get high prices for their honey ; but perhaps it was sometimes their own fault, that they could not sell, by asking prices which were too high. In one case at the Exhibition the worthy owner of some exhibits had done nothing with them except pay their carriage up to London and home again. It would be far better for people to sell at the market price, whatever it was. They ought to see what they could do in the matter, and try whether the English public could not be induced to purchase pure honey, put in a plain and simple form before them, at a reasonable market price. If the matter was to be really taken up by the public, it must be treated upon the general laws of supply and demand. On behalf of the honey depôt already established at Reading, and the others which he hoped to establish at London, Edinburgh, and Dublin, he could say that they would do all they could to buy up the honey produced in their district, and so endeavour to do what they could towards keeping at home the thousands of pounds which were at present spent by the British public in foreign articles, and were in that way sent out of the country.

Mr. CHESHIRE said that as Mr. Hehner had suggested to them the propriety of labelling honey and indicating its principal source, it had occurred to him that that ability to, as it were, "spot" the source of a piece of comb from an examination under the microscope might be made of great service, and in that way he would be very glad to be of use. He would endeavour to make out from any pieces of comb that might be sent to him what were the sources of the honey.

A VISITOR would very much like to know what Mr. Moyle thought on the subject of price. A reasonable price had been referred to, and he would be glad to know what was considered a reasonable market-price for say 100 lbs. of honey.

The Rev. V. H. MOYLE said the price he had been giving was 9*d.* per lb. for 100 lbs. parcels in 1 lb. sections, and paid the carriage.

The Rev. LAWSON SISSON said he had purchased two samples in Norwich the other day, and a grocer in the town came up and asked him to sell the honey at so much per section, stating that he would give a guinea per score for the 1 lb. sections. He did not think, therefore, that he got a very low price for that honey according to Mr. Moyle's statement.

Mr. BLOW was not aware whether all members present might have noticed that the honey which was placed on the market by foreign merchants was clear. The so-called "Swiss" and "Californian honey" he had seen was clear, and it was, he believed, owing to that fact that this honey obtained a ready sale. The public apparently liked a clear honey, and that was just what the English bee-keepers did not produce. He had a number of customers who would not buy crystallised honey, they must have it clear, and in all cases where that was done, as with the foreign honey, it was readily sold. In fact English bee-keepers did not put up their honey in a form to command attention. Foreign honey was put up very nicely indeed, and it therefore attracted the public, but the way English honey was put up was not nice at all.

Mr. BERNARD DYER, as an analyst not being a bee-keeper, though he contemplated keeping bees on a small scale, entirely endorsed the appreciative remarks which had been made upon Mr. Hehner's paper. It had been well said that nobody could truly appreciate a picture so well as an artist; the ordinary observer saw the effect produced by a picture, and might admire it for its excellence, but it was only an artist who could fully appreciate it as a work of art, because he could recognise its technicalities of painting and the labour involved in producing it before it saw the light. And so, no doubt, bee-keepers would be best able to thoroughly appreciate the results arrived at in connection with these subjects. But chemists, too, would very deeply appreciate the value of scientific labours by which Mr. Hehner had arrived at those results, and he was happy to say that he had been fortunate enough to have the opportunity of observing Mr. Hehner's progress in his researches in these subjects, not only with regard to honey, but with regard to bees-wax and other matters connected with the hive.

A MEMBER suggested that it would be well if lists of prices could be published as a guide to both buyers and sellers of honey.

Mr. J. P. SAMBELS mentioned a sample of last year's honey which had been submitted to Mr. Hehner, and which had kept beautifully clear down to the present time. Probably that gentleman would kindly give them the results, from a chemical point of view, of that sample of about 1 lb. which had been submitted to him in the clear, whereas other samples which had not been submitted to him had crystallised. The former had kept in beautiful condition down to the present, and would sell readily now. It had remained the same as before, and the flavour had not been in the least affected by the heat, though, no doubt, if honey were submitted to a very high temperature the flavour would be very considerably affected.

The Rev. GEORGE RAYNOR referred to the fact that the so-called "Narbonne honey," obtained from chemists' shops, was usually purchased by nurses for invalids and children from an idea, probably, that being sold by respectable chemists it might be expected to be pure. He would like to hear Mr. Hehner's opinion with regard to the Narbonne honey, which of course was supposed to be gathered by bees. One specimen, produced in the marshes of Lincolnshire, had been referred to by Mr. Hehner as having a special flavour, which he described. Honey gathered from bean-plants in the early part of the season was light in colour and very similar to clover-honey; but later in the season, when the bean-plants had become affected by attacks of blight, the honey brought in from them was very dark indeed. With regard to the question of pollen being carried into the hives by the bees to a greater extent in some cases than in others, and thus becoming mixed with the honey, he would make a suggestion whether that might not arise from the honey being taken, in the different cases, from different parts of the hive. They knew that the bees placed the pollen, and also a certain amount of honey, near to the brood. In the feeding of the brood by the nurse-bees the pollen became mixed with the honey in the immediate neighbourhood of the brood-nest; whereas if the honey were taken from the outer sections of the same hive it would be precisely of the same description but without any admixture of pollen with it. He would therefore suggest whether it ought not to be noticed in any experiments which were made hereafter, from what part of the hive the honey was taken.

Captain CAMPBELL, as Treasurer of the Surrey Bee-keeper's Association, thought he might say a few words which would help towards the elucidation of the question. He was one of the Committee which had procured the samples mentioned, and their opinion was most emphatically that they were obtained in the natural manner by the bees without any extraneous assistance, and they were taken from sectional supers in the tops of the hives. That would perhaps answer the question as to whether the honey had not been accidentally mixed up mechanically with the pollen in the hives. As to cottage bee-keepers being unable to find a market for their honey, he believed their great difficulty lay in their not being able to make it up for sale in a marketable form. When it was explained to them how that might be done by warming the honey, there was then another difficulty in preventing them from fairly boiling it, and turning it almost into treacle. So that he had found that his efforts to assist a cottager in that way had sometimes unhappily resulted in destroying the poor man's profit altogether. Honey could be cleared by being warmed up to a certain temperature ; he had never certainly gone up to as high as 120°, but he had warmed honey up to 90°, and had found that that temperature did not appear to destroy its aroma, unless it was subjected too long to the heat. If it was exposed to a high temperature for a long time it must have lost what it was so essential to have in good honey. In the *Journal* of the 15th of July, he had noticed a statement that there had been 1300 tons of honey sent from Chili to Germany and England in about equal proportions ; and a gentleman living near Guildford, a retired man of business and large bee-keeper, had remarked to him that it was impossible they could ever supersede foreign honey in the English market, for in the West Indies, for instance, they used to buy it by tons, and it was then put into boxes, shipped, and sold in the English market, so that the British bee-keepers would never be able to compete with that. But he thought Mr. Moyle had pointed out the right direction for obtaining a good market for their honey. A lady bee-keeper at Salisbury had mentioned to him that she had given up bee-keeping because she could not find a market for the honey ; but very often he thought the difficulty lay in getting the honey clear. Among the hints given to bee-keepers in the *Journal*, it was stated that now was the time for bee-keepers to fill up their sections, and if they were for market, to feed up the bees with honey—"pure honey, of course"; but that if they were for exhibition and competition, that would not be permitted. He thought that was a very dangerous sentiment that they should get their boasted pure English honey, which was to supersede that from all the rest of the world, by feeding the bees up with "pure honey, of course"; and he thought that perhaps a good many people would not be particular, "of course," as to where they got their honey from. He had been, in one instance, offered honey at 6*d.* per lb., because it was not put up in good form, and could not find a market; if he had given it to the supers, and had then sold it again at 1*s.* 6*d.* per lb., he might have been in that case an honest man, in a business point of view. But he would not say anything more about it, because he thought it would be much better not to suggest to people any means of getting their supers filled with artificial honey, because it seemed rather too like following the old adage, "Catch your hare if you can, but if you cannot, steal it."

The CHAIRMAN said, if Captain Campbell would quote chapter and verse from the *Bee Journal* for the matters he had referred to, no doubt he could be satisfied on the points he had mentioned. There was one point as to which a question had been put to him, upon which, however, his memory was not sufficiently good to afford an answer; but perhaps some gentleman present would kindly state what was exactly the value of honey imported into England from foreign countries generally during the last month from the returns given by Mr. Bellairs from the Customs returns.*

Mr. MOYLE informed the Conference that the returns showed there had been last month £15,387 worth of foreign honey imported into this country.

The CHAIRMAN said that Captain Campbell had alluded to a lady in Salisbury who had been unable to find a market for her honey, and perhaps Mr. Burkitt, of the Wiltshire Association, might be able to say something which would encourage her.

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* See Appendix, p. 261.

The Rev. W. A. BURKITT was understood to say that he was not attending in a representative capacity, and was scarcely able to respond to the Chairman's invitation.

Mr. J. M. HOOKER agreed with Captain Campbell that the advise given in the *British Bee Journal* as to feeding extracted honey was very dangerous. If honey could be bought for 6*d.* a pound and fed to bees, and the 1-lb. sections could be sold for 1*s.* 6*d.*, it would of course seem as if a large profit could be made; but as a practical bee-keeper he would undertake to say it would not pay to feed pure honey, as not one third of that fed at this season of the year would ever be put into the sections.

Mr. OTTO HEHNER, in reply, said he was in the fortunate position of not having to respond to any criticisms. He would first refer to the remark of the Chairman as to the action of the Health Exhibition authorities. He had been furnished with samples of honey for analysis; they were afterwards put into a show-case, and he was told that those samples had attracted a good deal of attention. Of course the labels on the bottles bore the names of the gentlemen who sold them, and he could not himself see how any good could be effected by simply giving the public a number of undistinguishable samples of adulterated honey, and failing to show the public where not to go for them. In that case he might have made up the adulterated samples himself, but the samples were exhibited just as they were purchased. The peremptory removal of that case of samples was, he thought, rather more than the occasion exactly required. However, if the Health Exhibition Committee did not think fit to bring the fact of the widely prevailing adulteration of honey before the public (and that case of specimens was the only exhibit in the building which claimed to show adulterated articles), he had, at any rate, done his duty by trying to draw the attention of the public to the matter. With regard to the action of local inspectors, of course the inspectors were directed by the town councils or other local authorities to collect samples. But the public themselves had a perfect right to collect samples and get them analysed. In fact, the Food and Drugs Adulteration Act was passed with that object. Still, of the 180,000 samples which had been analysed, hardly 1000 had been furnished by the public, because of the difficulties in the way. First of all, the exact letter of the Act of Parliament must be complied with, and it was not to be expected that every outsider should know exactly what he had to do; they had to formally divide the samples into three parts, seal them up, and then to pay half-a-guinea to have them analysed; take the matter into Court; prosecute and get the man who had sold the article punished. Of course nobody would care to undergo all that trouble, and therefore private persons could not be expected to prosecute tradesmen for adulteration, the remedy in their own hands being apparently so easy, because, of course, they could go away and deal with another tradesman, though very often the further they went the worse they fared. But if the Bee-keepers' Association could act in the matter, and bring sufficient pressure to bear upon the authorities, there would at once be a solution of the difficulty. Then as to the question why by warming honey it does not crystallise, he could only suggest the following explanation: Dextro-glucose was crystallisable, and by heating it was not destroyed, it was still there, but it was a remarkable fact, that very small quantities of albuminous substances prevented the dextro-glucose from crystallising. Such substances were contained in honey. The pollen granules, which were of a nitrogenous nature, on heating discharged their contents, and in that way furnished the albuminous substance which was inimical to crystallisation. That was the only way in which he could explain the fact that after being heated honey would not crystallise. It was quite true, as had been pointed out, that corn sugar need not be made with sulphuric acid, and that it might be made with oxalic acid. In fact he had pointed out that fact himself on a previous occasion, but he thought it was not wise to educate people to such an extent as to enable them to cheat the public. As a matter of fact it could be done, but as a matter of practice it was not done, at least at the present time. As to the properties of honey-dew, he would be delighted to experiment with it, if a sample were furnished him, say, an ounce or two ounces of it. If any gentleman would kindly send him some he would be glad to analyse it and give them the result. As to Narbonne honey, he had analysed some samples which he had found to be genuine. Then as to finding new channels for the sale of home produced honey he would venture to make a suggestion. It would be desirable to see the old-fashioned Saxon beverage mead brought up again to a somewhat higher repute than it had at present fallen to, and now that people were pretty generally aware that beer was not always made from pure malt and hops, there was a much better chance of that old fashioned beverage being revived in public favour.

The CHAIRMAN, in proposing a hearty vote of thanks to Mr. Hehner for his admirable paper, said that Mr. Cowan, who was, he might say, the guiding light of their Association, had endeavoured while in Switzerland to obtain samples of pure honey at the *tables-d'hôte*, but the proprietors told him that, while they were perfectly willing to provide pure honey, they were obliged to put adulterated stuff on their tables to suit the tastes of English tourists. That fact showed the necessity for educating the public taste in this matter. He would make one other remark with regard to the substitution of *oleo-margarine* for genuine butter. At Shrewsbury he had a conversation with Canon Bagot, who had interested himself so much in introducing good farming among the people in Ireland, and the Canon had told him he had found great difficulty in the matter, not only from the quality of the butters submitted for his opinion, but from the fact that the wholesale dealers were actually selling the stuff to retail dealers as pure butter, that the Adulteration Act was simply a dead letter, and that, until some amendment was made in its operation, he was hopeless of doing any good in the line which he had marked out for himself in Ireland.

Mr. SCLATER had great pleasure in seconding the vote of thanks to Mr. Hehner for the trouble he had taken in bringing the subject so ably before them. The first thing which British bee-keepers had to do was to stop, if possible, the sale of the adulterated honey which was at present put on the market, and also to pay special attention to the point of supply and demand, and to establish a means for bee-keepers to find out the actual market price for the article they were prepared to sell. If producers of honey could offer it to buyers at its known commercial value, they would do a great deal to check the sale of adulterated honey, because, of course, if they put a price upon their honey which was not warranted by its commercial value in the market, they immediately gave a stimulus to the preparation and sale of the adulterated article. That point should not be lost sight of. In his own county, Buckinghamshire, complaints were made on all sides about the difficulty producers found in selling their honey, but he felt sure, if they made their prices dependent on supply and demand, much of the difficulty which they at present experienced would disappear.

The vote was put and carried unanimously.

Mr. HEHNER, in returning thanks, said his aim in taking up the subject of the composition and nature of honey had been purely scientific. The ambition of the scientific man should always be to arrive at the truth, and he was most happy if he had been able to do anything to elicit it.

The Conference terminated with a vote of thanks to the Chairman.

APPENDIX.

LIST OF FLOWERS SOUGHT AFTER BY BEES, SHOWING THEIR VALUE AS HONEY AND POLLEN PRODUCERS.

Those producing a moderate quantity represented by **1.**
,, ,, a large ,, ,, by **2** *good.*
,, ,, a very large ,, ,, by **3** *very good.*

Prepared by THOMAS W. COWAN, ESQ., F.G.S., F.R.M.S.

(*Chairman of Committee of the British Bee-keepers' Association*).

Name of Flower.	Honey Value.	Pollen Value.
Ajuga reptans (Common Bugle)	3	—
Allium Moly	3	—
,, acutangulum	2	2
Althæa rosea	3	—
Alyssum, sweet	1	—
,, saxatile	1	—
Ampelopsis hederacea	2	—
Aquilegia (Single)	1	—
Arabis alpina	2	1
Asclepias syriaca (Virginian Swallow-wort)	3	3
Aubretia græca	1	—
Balsam (Single)	2	—
Berberis vulgaris (Berberry)	2	1
Borago officinalis (Common Borage)	3	—
Cannabis sativa (Hemp)	—	1
Canterbury Bells	2	1

Name of Flower.	Honey Value.	Pollen Value.
Centaurea cyanus (Corn Blue-bottle)	2	—
„ scabiosa	3	3
Cheiranthus cheiri (Single Wallflower)	3	1
Clarkia pulchella	2	—
Clematis Jackmanni	1	—
„ montana	1	—
Colchicum autumnale (Meadow Saffron)	1	—
Corydalis cava	2	—
Cratægus Oxyacantha (Hawthorn)	3	1
Crocus vernus	3	3
Cucurbita Pepo (Pumpkin)	1	—
Deutzia crenata	2	—
„ gracilis	2	—
Eranthis hyemalis (Winter Aconite)	2	1
Erica carnea	3	—
„ vulgaris	3	—
Eschscholtzia crocea	—	1
Forsythia pendula	1	1
Fritillaria imperialis	3	3
Fuchsia	2	—
Galanthus nivalis (Snowdrop)	2	—
Hedysarum coronarium (French Honeysuckle)	3	3
Helianthus annuus (Single Sunflower)	1	1
Helleborus niger	2	3
Hibiscus syriacus	1	1
Hyssopus officinalis (Hyssop)	1	—
Ligustrum vulgare (Common Privet)	2	—
Limnanthes Douglasii	3	—
Lonicera caprifolium	3	—
„ tatarica	2	—
Malva grandiflora (Mallow)	1	3
„ moschata (Musk Mallow)	1	3
„ „ alba	1	3
Medicago lupulina (Trefoil)	3	1
„ sativa (Lucerne)	3	1
Melianthus major	1	—
Melilotus altissima	3	1
„ alba	3	1
„ cærulea	2	—
„ leucantha (Bokhara Clover)	2	1
Mentha arvensis (Corn Mint)	2	1
„ piperita (Peppermint)	3	—
Myosotis palustris (Forget-me-not)	2	—
„ dissitiflora	2	—
Narcissus poeticus	1	—
Nigella damascena (Fennel Flower)	2	—

Name of Flower.	Honey Value.	Pollen Value.
Onobrychis sativa (Sainfoin)	3	3
Orobus vernus (Spring Bitter Vetch)	I	—
Papaver somniferum (Single Poppy)	—	3
Phacelia tanacetifolia	3	2
„ congesta	I	I
„ alba	I	I
Polygonium Fagopyrum (Buck Wheat)	2	—
„ sachaliense	2	—
Polymonium cæruleum (Greek Valerian)	3	3
Primula vulgaris (Common Primrose)	I	I
„ veris (Cowslip)	2	I
„ officinalis	2	I
Reseda odorata (Mignonette)	3	2
Ribes sanguineum (Currant)	2	—
„ rubrum (Red Currant)	I	—
„ nigrum (Black Currant)	I	—
Ribes Grossularia (Rough Gooseberry)	2	—
Robinia Pseudacacia (Acacia)	3	I
Rubus fruticosus (Common Bramble)	2	2
„ Idæus (Raspberry)	3	I
Salvia pratense (Meadow Sage)	3	—
„ officinalis (Garden Sage)	2	—
Scilla sibirica	2	2
Scrophularia nodosa (Figwort)	3	—
Sedum anglicum (English Stone Crop)	2	—
„ acre (Biting Stone Crop)	I	—
„ Telephium (Orpine)	3	—
„ major	3	—
Silene pendula (Catchfly)	I	—
Sinapis alba (White Mustard)	3	I
Spiræa Ulmaria	—	2
„ Aruncus	—	2
Stachys lanata (Woolly Hedge Nettle)	I	—
Symphoricarpus racemosus (Snowberry)	3	—
Symphytum asperrimum (Comfrey)	2	—
Teucrium italicum (Germander)	3	—
Thymus citriodorus (Lemon Thyme)	2	—
„ serpyllum (Wild Thyme)	2	—
Trifolium montanum (Mountain Trefoil)	2	I
„ incarnatum	I	I
„ repens (White Clover)	3	2
„ hybridum	3	2
Tropæolum (Nasturtium)	2	—
Tussilago alba (White Butter Bar)	3	—
Veronica latifolia (Speedwell)	3	I
Verbascum thapsus (Mullein)	—	2

Name of Flower.	Honey Value.	Pollen Value.
Verbascum phœniceum (Purple-flowered Mullein)	2	—
Vicia sativa (Common Vetch)	3	—
Vinca minor (Periwinkle).	2	—
Viola odorata (Sweet Violet)	3	—
„ tricolor (Pansy)	2	—

The following extract from a lecture by Mr. H. M. Jenkins, F.G.S., is reprinted from the *British Bee Journal*:—

Bee-keeping is a source of income to the farmer of no great amount perhaps, but still an appreciable and a welcome addition to either his money receipts or the food supply of his family, especially if he should have young children. Here again the care of the farmer's wife is essential, more particularly in studying the habits of the bees and separating the honey from the comb. I am not competent to give you a lecture on bee-keeping, nor is it necessary that I should do so; for practical demonstrations are now given at the agricultural shows by gentlemen who have made the subject their special study. What I wish to point out is the duty of the farmer's wife in reference to this small portion of the "agricultural fringe." Small it really is in the United Kingdom; but in many districts where heather abounds it is a very considerable item in the farming economy, as, for instance, in the heath-land districts of some provinces in Holland.

First of all, there is the relation between the bee-hives and the poultry yard. Keep them as far apart as possible, otherwise the fowls will manage to eat a large number of the bees. Then take care that the bee-hives, like the rabbit-hutches, are well ventilated and protected from moisture and from cold. Bees are no exception to the general rule. They require warmth, but it must not be produced by half stifling them; both cold and damp will kill them, and so will starvation in the winter. Feeding bees in the winter is, in fact, the only expense they entail except that for their hives, which need be only trifling. A very serviceable hive can be easily made out of an American cheese-box. The chief food given by the best authorities is white sugar or barley sugar made into a syrup, with a little vinegar added; and that surely is cheap enough. Then recollect that it is not necessary to destroy the bees in order to keep the honey. A little drowsiness induced by the fumes of tobacco or touch-paper is quite sufficient to enable the honey harvest to be secured.

A very successful lady bee-keeper, Miss Gayton, who lives near

Ware, in Hertfordshire, has, at my special request, written to me as follows: "From my own experience I am sure that almost every cottager might make his bees pay his rent and more; and with five or six hives the trouble of attending to them is not more than he and his wife could find time for. One thing, however, is absolutely necessary for success in bee-keeping, namely, to thoroughly study and understand the habits and requirements of bees, and to bestow on them as much care and attention as would be required for any other pursuit or occupation in order to be successful. Having but small means, I began bee-keeping with the hope of making it a profitable pursuit. I have kept a strict account of every expense, and, as my statement shows, I have found bee-keeping profitable."

Miss Gayton's very clear statement of accounts shows that she began bee-keeping in 1876 with one stock of bees, and expended 1*l.* 12*s.* 6*d.*, which she charged to capital. She was not in a hurry to make money, so that next year she devoted the honey to increasing her stock of bees to six, and spent 8*l.* 10*s.* 5*d.* in providing accommodation for them, as well as 1*l.* 4*s.* 4*d.* in working expenses. This latter item was, of course, a dead loss, but it is the only loss she has made in the eight years, 1876–83. During the last three years she has had twenty-seven or twenty-eight stocks of bees, and during the eight years she has spent no less than 103*l.* 5*s.* 11*d.* in hives and apparatus of all kinds. Her gross receipts have amounted to 191*l.* 8*s.* 6*d.*, her total working expenses to 34*l.* 12*s.* 5*d.*, so that her net profits came to 156*l.* 16*s.* 1*d.*, or enough to repay her capital expenditure and leave a balance in hand of 53*l.* 10*s.* 2*d.* Of course, the profits in any year vary with the season. Last year, for example, they amounted only to 15*l.* 17*s.* 1*d.*, and this year, with one hive less, they reached the very respectable sum of 60*l.* 7*s.*

Miss Gayton adds that she has found bee-keeping a most interesting occupation, and says further: "Each year now I hope to gain a still larger profit, for I have hives for as many stocks as I have room for, and all necessary appliances, so that, beyond the annual outlay for food and working expenses, I hope to have no need for further expenditure. I manage and attend to my bees entirely myself; and, for the encouragement of those who dread stings, I may mention that, although at first I suffered very much from the effects of a sting, I now experience no discomfort except the slight pain at the minute. I have learnt not to be afraid of bees, but handle them quietly and gently, taking care never to kill a bee unavoidably; and with no protection except a veil, I can do anything with them, with only an occasional sting. With regard to exhibiting honey, although it costs a good deal, prizes gained repay this. (Miss Gayton has spent 8*l.* 10*s.* 11*d.* in exhibiting, and has won 17*l.* 19*s.* 9*d.* in prizes.) But the benefit in every way I consider very great as a means of disposing of honey, and particularly (please note this) from all one learns and sees, and from the help and ideas one obtains from other bee-keepers."

Miss Gayton further informs me that the bees obtain their honey chiefly from ordinary spring flowers, sainfoin, sheep feed, &c., and later, lime-trees and white clover. The honey harvest ceases when the lime-blossom is over. There is no heather in her district. She has never had any difficulty about disposing of honey, and sells comb honey at 1*s.* 6*d.* per lb., and extracted honey at 1*s.*

The foregoing is a very brief sketch of what one lady—a farmer's sister—has done in bee-keeping, commencing with a single hive, and gradually increasing her stock to twenty-eight hives in the course of six years, and making during the whole period of eight years an average profit of nearly 20*l.* per annum.

SUCCESSFUL BEE-KEEPING.

Since the delivery of the above lecture, a tabulated statement of the working of Miss Gayton's apiary at Much Hadham, Hertfordshire, from 1876 to 1883, has been kindly permitted to be published.

The account shows that all capital expended—viz., 103*l.* 5*s.* 11*d.* —has been refunded, leaving a clear profit of 53*l.* 10*s.* 2*d.* No charge is made for rent of land, time of superintendence, or interest on capital. The same result could have been obtained with less outlay under experienced management. For instance, many expensive hives were purchased in the first instance. The plant now consists of twenty-seven stocks (Ligurian, half-bred, and black bees), all very strong, well supplied with sealed stores for winter; in good working order, in thoroughly good hives, with all necessary appliances, and eight extra hives complete for another season.

The pasturage in this district consists of ordinary spring flowers, sainfoin, sheep feed, &c., and, afterwards, lime-trees and some white clover; and honey harvest ceases when the limes have bloomed. No heather. A ready sale can be obtained for honey in sections at 1*s.* 6*d.* per lb., and extracted honey at 1*s.* per lb.

Year.	No. of Stocks.	Capital.	Expenditure.		Receipts.			Profit.	Loss.	Season.
		Plant.	Working Expenses.	Entry Fees, Travelling Expenses to Exhibitions, Commission on Sales.	Bees.	Honey.	Prizes.			
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
1876*	1	1 12 6	..	..	..	..	..	..	..	..
1877	6	8 10 5	1 4 4	..	..	..	..	..	1 4 4	Bad.
1878	9	10 12 11	1 13 1	..	..	8 0 10	..	6 7 9	..	Fairly good.
1879	15	9 7 9	2 12 1	0 2 6	..	6 1 1	1 0 0	4 6 6	..	Bad.
1880	22	11 12 9	3 17 7	2 3 0	5 8 0	26 6 5	2 10 0	28 3 10	..	Good.
1881†	28	28 10 0	3 15 8	3 2 6	..	45 8 5	4 8 0	42 18 3	..	Very good.
1882‡	28	15 13 2	6 8 9	1 9 7	0 12 6	16 16 2	6 6 9	15 17 1	..	Very bad.
1883§	27	17 6 5	6 10 0	1 13 4	‖2 13 11	62 1 5	3 15 0	60 7 0	..	Good.
		103 5 11	26 1 6	8 10 11	8 14 5	164 14 4	17 19 9	158 0 5	1 4 4	
			8 10 11			8 14 5		1 4 4		
						17 19 9				
			34 12 5					156 16 1		
						191 8 6				
						34 12 5				
						156 16 1				

* Started in autumn by purchasing one stock of black bees in skep. No honey taken, simply increased stock.

† All honey taken before first week in July. Four best hives yielded respectively 87 lbs., 86 lbs., 84 lbs., 81 lbs.

‡ Best hive only 29 lbs. Many hives gave no surplus.

§ After very trying winter and spring early part of honey season was very good; latter part indifferent. Largest produce from one hive 78 lbs.

‖ In addition to bees sold, bees given to cottagers to value of £3 12*s.*

The following instance of the profits made by a cottager during the present year (1884) has been brought to the notice of the Association. The man commenced in the spring with four stocks in good condition, the value of which would be about 30*s.* each. Two of the stocks swarmed, thus adding two more hives and making his total six. These six stocks have produced more than 300 lbs. of honey during the present season, worth at the lowest estimate 15*l.* The whole of the hives are now in excellent condition, with ample stores for the winter, and their value may be put down as at least 2*l.* each, or 6*l.* more than the original outlay. The total expenditure for the year will not exceed 2*l.*, thus leaving a profit of nearly 20*l.* The owner is an artisan, working from 6 in the morning till 5·30 P.M.

TABLES SHOWING THE QUANTITY AND VALUE OF HONEY IMPORTED INTO THE UNITED KINGDOM, COMPILED FROM THE CUSTOMS RETURNS, BY MR. E. H. BELLAIRS, WINGFIELD, CHRISTCHURCH, HANTS.

1882.

	Cwts.	£
Germany	11,090	30,015
Portugal	4,943	24,064
Japan	7,337	16,910
United States	4,213	16,626
British East Indies	1,025	6,758
British West Indies	1,194	7,378
Other Countries	5,736	25,175
	35,538	126,926

1883—84.

	1883. £	1884. £
January	1,612	2,034
February	2,175	2,234
March	1,535	2,545
April	1,518	4,962
May	4,781	5,245
June	3,534	..
July	7,496	..
August	6,262	..
September	972	..
October	725	..
November	1,908	..
December	1,260	..
Total	£33,778	£15,387

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